STRATEGY RESEARCH PROJECT

INTEGRATING KNOWLEDGE MANAGEMENT INITIATIVES FOR THE FUTURE ARMY

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ABSTRACT

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TITLE: Integrating Knowledge Management Initiatives for the Future Army

FORMAT: Strategy Research Project

DATE: 5 May 2000 PAGES: 80 CLASSIFICATION: Unclassified

Using the Wisdom Triangle/Pyramid as its foundation, this research paper provides recommendations for an Army Knowledge Strategy, which combines the value of sharing business knowledge with today's computer industry's pursuit at developing a "human machine." One of the best business practices is sharing knowledge within the company/firm. If the Future Army is to maintain its reputation as being the most potent land combat force in the world, it must broaden its efforts to identify, capture, prioritize, organize, create and share Army knowledge. Innovations of today's computer industry advocate the development of a "human machine," a machine that thinks and learns on its own, a machine that imitates a man's brain. The Army should leap beyond the mere exploitation of today's technology and keep abreast with this future innovation. Tomorrow's technology will be the conduit for sharing knowledge not only among soldiers and its future generations, but also among unmanned weapon platforms integrated together to share knowledge (of the battle situation, terrain, courses of action, and threat information) in achieving a commander's objective on the battlefield or to secure national security objectives. The Army should begin implementing initiatives involving data, information and knowledge that provide the basis for machines to think and learn, as unmanned weapon platforms will one day be a reality. Incorporating the recommendations as explained in this paper offers a simple strategy from which to build a Knowledgeable Army.

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ACKNOWLEDGEMENTS

Several colleagues reviewed different versions of this manuscript and made constructive suggestions. Without their assistance, the text could not have reached in its present shape. Their help and comments are greatly appreciated. Other gratitude goes to:

- Dr. George Kozmetsky, an industrial visionary, whose many unpublished manuscripts hold the key to improving organizational knowledge.
- Dr. Robert E. Neilson, the creator of a Chief Knowledge Officer curriculum at the Information Strategy Department, Information Resources Management College, National Defense University, who first introduced me to Knowledge Management and the Wisdom Triangle/Pyramid.
- Dr. Jerry Davis, Director, Center for Professional Development and Training, University of Texas at Austin, for his support of an evolving idea for a Knowledgeable Army.
- Professor William W. Cooper, Auditor of the Marshall Plan, for his suggesting a systemic approach in the presentation an evolving topic.
- Antonio "Tony" P. Monaco and James H. Ritter, creators of a virtual university at the Center for Army Lessons Learned, that their continued efforts make it a reality for a Knowledgeable Army.
- Jack H. Sheehan, Data Engineer, Defense Modeling and Simulation Office, for providing insights in collecting the right type of data.
- Prof. James Hendler, the "guru" of intelligent agents in the Information Systems Office, Defense Advanced Research Projects Agency, for information on the Control of Agent-Based Systems.
- LTC Marion Van Fossen, Program Manager, Defense Advanced Research Projects Agency, for sharing his concept of the Future Combat System.
- LTC Edward Milster, Deputy Director, Digital Force Coordination Cell, Fort Hood, Texas for his support and information on "Digitizing the Force".
- Rupa Sriram, Web Quality Assurance Manager, *ibooks.com*, for sharing her company's innovative idea of providing a virtual reference bookshelf.
- James Pollard, Coordinator, Senior Service College Program, University of Texas at Austin, for accommodating additional attendance at numerous technology seminars adding ideas for strategic recommendations.
- Zietta "Zee" Ferris, Defense Manpower Data Center, for her immediate feedback of military personnel statistic requests.
- T. Rey Calderon for drawing the initial Army Knowledge Pyramid and Kimberly J. Beck for completing the rest of the colored illustrations.
- Jamie L. Ritchey, Army Reserve Personnel Command, for not knowing that her suggested referrals of information technology web pages provided ideas in sharing knowledge.
- Nelson P. Young, who many years ago, introduced me to chess.
- Felix, Sr. and Felicidad for their wisdom.

Last, but not least, I want to thank my wonderful wife, Nicofina, for being so patient during this adventurous quest. As always, I am truly grateful for her moral support.

LIST OF ILLUSTRATIONS

INTEGRATING KNOWLEDGE MANAGEMENT INITIATIVES FOR THE FUTURE ARMY

This paper provides recommendations to integrate knowledge management initiatives in preparation for the Army's transformation in the utilization of unmanned weapon platforms resulting from evolving technology. Knowledge is crucial for the existence of an organization, and one of the best practices in business today is sharing knowledge within the company/firm. To share knowledge requires that knowledge be properly managed. Knowledge management is "a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into actions in ways that strive to improve organizational performance."[1] In an age when reengineering and downsizing are commonplace for the Department of Defense, the resulting consequences of losing valuable Army knowledge continues to grow at an alarming rate. Recruitment and retention problems also compound this problem as soldiers leave to pursue employment in a flourishing economy.

The concept of the Future Army must capitalize on the advancements of evolving technology that's transitioning towards the development of a human machine. To strategize an Army Knowledge Infrastructure, this paper uses the Wisdom Triangle/Pyramid concept. Like the building blocks in a Lego toy set, the Army must develop each level of the Wisdom Triangle/Pyramid in preparation for the insertion of autonomous weapon platforms in its arsenal. Building knowledge for the soldier must expand together with the knowledge development for a human machine. Sharing knowledge must be incorporated throughout this infrastructure by implementing initiatives that manage data, information and knowledge in providing the basis for machines to think and learn. Rather than having soldiers fight a conventional war, the Future Army shall be forced to use autonomous weapon platforms because of technology advancements. Based on the assumption that conventional warfighting knowledge is being lost to numerous missions involving operations other than war, recommendations provided in this paper support unmanned weapon platforms for use in a conventional war or conflict.

THE FUTURE ARMY CONCEPT

> *No man can do anything without knowing what he is doing...Generals and staff officers don't win wars! The soldier must know what he is doing at all times. He must know the objective.*
>
> — General George S. Patton, Jr.

The Future Army is a military land force, fighting "joint" with the other services, and implementing 21st Century technology advancements of embedded knowledge in unmanned weapon platforms for use in a conventional war.[2] Embedded knowledge proposes three modes of operation fitted into unmanned weapon platforms: manual, semi-autonomous, or full autonomous. Some missions or tasks cannot be programmed to function autonomously and must interact with soldiers in a manual mode of operation. Manual mode in this context means to remotely operate the unmanned weapon platform from a distance. Although unmanned weapon platforms do not require human interaction, some missions or tasks demand interaction for use in a semi-autonomous mode of operation. Eventually, full autonomous weapon platforms are the goal of future Army technology. It is designed to perform missions and tasks without interaction from the operator, i.e., an Army soldier.

This Future Army concept can be likened to a futuristic chessboard (an analogy used in this paper) of integrated pieces, each piece learning on its own, sharing information among other pieces, and maneuvering around the board with a collective objective of checkmating the enemy King in such a way that there is no escape. Various weapon platforms have a unique purpose on a battlefield, just as in chess, the pieces are limited by its unique moves on the 8-by-8 square board. It takes approximately 80 moves per game, but there is more to it than knowing how to move.

A chess game has three phases: the opening, the middle game and the end game. Each of these phases has a unique objective. The fundamental objective in the opening is

development, i.e., to build a winning opening position in a few precious moves, halt, and begin the middle game. Rules for the opening are shown in Figure 1.

1. Open with either the King's Pawn or the Queen's Pawn.
2. Wherever possible, make a good developing move which threatens something.
3. Develop Knights before Bishops.
4. Pick the most suitable square for a piece and develop it there one and for all.
5. Make one or two Pawn moves in the opening, not more.
6. Do not bring your Queen out early.
7. Castle as soon as possible, preferably on the King's side.
8. Play to get control of the center.
9. Always try to maintain at least one Pawn in the center.
10. Do not sacrifice without a clear and adequate reason.

FIGURE 1. TEN FUNDAMENTAL RULES FOR THE OPENING[3]

The chief strategic objective in the opening is the most effective and harmonious development of all the pieces.[4] Time is of the essence in the opening; players must develop quickly or not at all. The opening of a chess game is similar to Operation Desert Shield of the 1991 Persian Gulf Conflict, which involved the "initial deployment of forces to deter further Iraqi aggression and to defend Saudi Arabia, and the subsequent deployment of forces to resource the coalition with a robust counteroffensive capability that could evict the Iraqi Army from Kuwait."[5]

Attack and defense are the characteristic features of the middle game. Again using the 1991 Persian Gulf Conflict as an example, the middle game is analogous to the first phase of Operation Desert Storm, a 34-day air operation initiated on 17 January 1991. Rules for the middle game are shown in Figure 2.

"Today's computer chess games contain programs that play the endgame rather less well than they play in the middle game,"[6] and tend to be less useful in adding genuinely

plausible moves. Current computer chess games are simply elaborate search devices that rummage through a database containing more than 1.4 million moves, but future chess games will evolve to learning and sharing information.

1. Have all your moves fit into definite plans.
2. When you are ahead in material, exchange as many pieces as possible, especially Queens.
3. Avoid doubled, isolated and backward Pawns.
4. In cramped positions free yourself by exchanging.
5. Do not expose your own King while the Queens are still on the board.
6. All combinations are based on a double attack.
7. If your opponent has one or more pieces exposed look for a combination.
8. To attack the King you must open a file (or less often a diagonal) to gain access for your heavy pieces (Queen and Rooks).
9. Centralize the action of all the pieces.
10. The best defense is a counter-attack.

FIGURE 2. TEN RULES FOR THE MIDDLE GAME[7]

"The minimum force required to administer a checkmate (when there is nothing else on the board) is either one Queen, one Rook, two Bishops, or a Bishop and a Knight. One Bishop or one Knight alone will not do. Surprisingly two Knights will not be able to force the win."[8] Just as different pieces are required to win, the lessons learned here is that using various weapon platforms brings about victory and supports a Joint venture among the other services. Using the same 1991 Persian Gulf Conflict as an example, the start of the end game is exemplified by the second phase of Operation Desert Storm, the land operations that began on 24 February 1991.

Rule 4 of Figure 3 recommend the need for Pawns in the end game. Although the destruction of the Iraqi Army did not end the Persian Gulf Campaign, a task force comprised of soldiers restored Kuwait and assisted in explosive ordnance disposal, public safety, health

service support, food and water distribution, sanitation, conversion of currency, reopening of banking and public school systems, and restoration of telephone, radio, and television service.[9] Pawns may end the game, but soldiers end the war. This comparison implies that in the end game, unmanned weapon platforms cannot replace the need for soldiers.

1. To win without Pawns you must be at least a Rook or two pieces ahead.
2. The King must be active in the endgame.
3. Passed Pawns must be pushed.
4. The easiest endings to win are pure Pawn endings.
5. If you are only one Pawn ahead, exchange pieces, but not Pawns.
6. Do not place your Pawns on the same color as you Bishop.
7. A Bishop is better than a Knight in all but blocked Pawn positions.
8. It is worth giving up a Pawn to get a Rook on the seventh rank.
9. Rooks belong behind passed Pawns.
10. Blockade passed Pawns with the King.

FIGURE 3. TEN RULES FOR THE END GAME[10]

Relating to his recent U.S. military experience in Bosnia, General Eric K. Shinseki, Army Chief of Staff, said, "It's the most difficult leadership experience I have ever had. Nothing quite prepares you for this."[11] In certain situations, machines cannot completely accomplish tasks that trained soldiers can do. Programming unmanned weapons platforms to conduct missions in operations other than war may be possible but not in the near future. With the Cold War over, the knowledge of fighting of a conventional war has diminished as soldiers retire, are forced out due to downsizing, or leave in expectation of making it big in a flourishing U.S. economy. If this continues and General Shinseki's vision of a highly deployable, light force is developed, the U.S. Congress may force the pull back of military forces stationed abroad in support of two

major regional conflicts, Southwest Asia and North Korea, and conduct a force projection from bases in the Continental U.S.

Today's M-1 Abrams tank can become disabled if it loses its track in a landmine, or takes a heat-seeking armament into the engine compartment. Unfortunately, the annihilation of the soldiers in the crew compartment via these means or from a nuclear, biological or chemical attack can render it inoperable. Exterminate the crew and the tank doesn't move. Therefore, to increase the survivability for any future tank is to design it without a crew. Developmental costs would decrease because human factors engineering is not a critical consideration. Crewless system designs make it much more mobile over any type of terrain and lighter than the light vehicles envisioned by General Shinseki. A common multi-variant platform could be designed for use by all Army branches, similar to the multi-variant concept of the current Family of Medium Tactical Vehicles (FMTV). Its sustainment base would require little or no personnel to operate. The platform could be programmed to complete a single mission or a multitude of tasks. Numerous unmanned weapon platforms could be inserted behind enemy lines without the loss of an American life. The uncertainty of what these unmanned weapon platforms can do on a battlefield is a huge deterrent factor that can break the will of any enemy.

The employment of unmanned weapon platforms resolves an economy of force issue. Any more future small regional conflicts, such as Bosnia or Kosovo, and the Army will overextend and overstrain itself globally to affect the readiness condition of fighting two simultaneous major theater wars. Deployed from CONUS bases, unmanned weapon platforms shall fight the initial battles, but soldiers will eventually be deployed, near the end of the conflict, after which unmanned weapon platforms should have performed brilliantly. Whether these autonomous systems battle in manual, semi-autonomous or autonomous modes of operation, the destiny of the Future Army will be the usage of unmanned weapon platforms that think and learn in a conventional war or conflict.

EVOLVING TECHNOLOGIES

> *Any piece of knowledge I acquire today has a value at this moment exactly proportional to my skills to deal with it. Tomorrow, when I know more, I recall that piece of knowledge and use it better.*
>
> — Mark Van Doren

The Future Army concept exemplifies a transformation process from current manned weapon platforms to unmanned weapon platforms, a somewhat similar conversion of a friendly game of chess played by two chess masters evolving into an automated chess tournament played by powerful computing machines.

In 1985, a Carnegie Mellon doctorial student named Fend-hsiung Hsu developed a chess-playing computer called "Chiptest."[12] In 1989, Hsu joined the IBM Corporation and began the Deep Blue project with Murray Campbell, his classmate at Carnegie Mellon. Deep Blue was an IBM research program that explored the use of parallel processing in solving complex computing problems. Over the years, the team designed a chess-specific processor chip that examined and evaluated two to three thousand positions per second using an IBM PowerParallel SP computer. Advanced improvements in Deep Blue was its remarkable speed running on an IBM RS/6000 SP high-performance computer, capable of calculating 100-200 billions of moves within three minutes.[13] Together with the power of the Power Two Super Chip (P2SC) on the newest version of the RS/6000 SP computer, Deep Blue will be able to explore 200,000,000 positions per second. World Chess Champion, Gary Kasparov, can examine approximately three positions per second.[14] This remarkable display of Deep Blue's advanced computing power illustrates the next future capability of performing chess strategies.

Powerful machines such as Deep Blue may someday lead to computers being "intimate." At least that's what Mr. Mario Tokoro – Corporate Senior Vice President, Sony Corporation – said at the 33rd Hawaii International Conference on System Sciences when he presented Sony's strategic vision on "intimacy," i.e., the importance of interactive and

responsive interfaces to make computers more intimate to users in their daily life. He claimed that,

> Personal computers have come to the home, and the Internet has proliferated. With TV changing to digital and merging with PC's, our living rooms are becoming networked. The digital cellular technology has made it possible for people to use computers when they are moving. These technologies have unquestionably made it easier to use computers and enabled ubiquitous computing.[15]

Sony's strategic plan has taken them to the next level, investigating the way people communicate and understand, in terms of both behavioral and neurological studies. Such studies suggest a research program focused on learning by imitation, whereby the interaction between perception, memory, and motor control that typically utilize very different representations, produce and learn novel behavior patterns. Mr. Tokoro played a video clip of AIBO, Sony's robotic dog that demonstrated several canine behavior patterns.

As Sony attempts to create intimacy with its products, computer researchers and developers have turned towards the mimicking of human behavior. The Public Broadcast System televised a special documentary feature, "Natural Born Robots" from *Scientific American Frontiers*. The narrator, Mr. Alan Alda (former actor from the weekly television series, *MASH*), introduced Manuela M. Veloso, an Associate Professor of Computer Science at Carnegie Mellon University and developer of robotic soccer teams, which have participated in a RoboCup international competition in three different categories. Figure 4 lists the results of the winning teams in RoboCup99 held in Stockholm.

Research scientists worldwide from various universities and colleges studying robotics and artificial intelligence conceived this Robot World Cup initiative nearly three years ago. Ms. Veloso's long-term research goal is to effectively construct intelligent agents[16] where cognition, perception, and action are combined to autonomously address planning, execution, and learning tasks. Although competition rules imposed on the size of the robotic soccer players,

she claimed that winning depends on speed and strategy, i.e., how fast vision algorithms can process images and the movement methods to kick and negotiate around obstacles.

- Simulation League
  - **World Champion**: CMUnited-99, Carnegie Mellon University, USA
  - **Second Place**: MagmaFreiburg, Albert-Ludwigs-Univ. Freiburg, Germany
  - **Third Place**: Essex Wizards, Essex University, UK
- Sony Legged Robot League
  - **World Champion**: Les 3 Mousequetaires, Laboratorie de Robotics Paris, France
  - **Second Place**: UNSW United, University of New South Wales, Australia
  - **Third Place**: CMTrio-99, Carnegie Mellon University, USA
- Small Size League
  - **World Champion**: The Big Red, Cornell University, USA
  - **Second Place**: FU-Fighters, Free University of Berlin, Germany
  - **Third Place**: Lucky Star, Nee Ann Polyhtechnic, Singapore
- Middle Size League
  - **World Champion**: CS Shariff, Sharif University of Technology, Iran
  - **Second Place**: Azzurra Robot Team, RoboCup Italia, Italy
  - **Third Place**: CS Freiburg, Albert-Ludwigs-Univ. Freiburg, Germany

FIGURE 4. WINNERS OF ROBOT WORLD CUP (ROBOCUP-99 STOCKHOLM) [17]

Robotic soccer is one example of complex tasks for which multiple intelligent agents collaborate in an adversarial environment to achieve specific objectives. This breakthrough offers a challenging research domain to investigate large issues of relevance in the development of fully autonomous agents. Hans Moravec,[18] whose current work focuses on enabling robots to determine their position and to navigate by a three-dimensional awareness of their surrounding, said that "by 2010, we will see mobile robots as big as people but with cognitive abilities similar in many respects to those of a lizard."[19] By 2040, we will finally achieve the original goal of robotics and a thematic mainstay of science fiction: a freely moving machine with the intellectual capability of a human being.[20] He is convinced that autonomous robots will be realized.

The Defense Advanced Research Projects Agency (DARPA), the central research and development organization for the Department of Defense (DoD), has continually been on the

forefront of evolving technologies. It manages and directs selected basic and applied research and development projects for DoD, and pursues research and technology where risk and payoff are both very high and where success may provide dramatic advances for traditional military roles and missions and dual-use applications.[21] In actuality, DARPA funds Ms. Veloso's work on intelligent agents.

DARPA's distinctive history traces back to its formally known name as the Advanced Research Projects Agency (ARPA), which introduced in 1971 ARPANET that linked large and expensive computers around the country in a network to share resources among organizations receiving ARPA's funding. ARPANET is the precursor of today's Internet. DARPA's mission is to develop imaginative, innovative and often high-risk research ideas offering a significant technological impact that will go well beyond the normal evolutionary developmental approaches; and, to pursue these ideas from the demonstration of technical feasibility through the development of prototype systems.[22]

The challenges in DARPA's many research programs will eventually be solved and fabricated for peaceful or deterrence usages as long as funding continues. Some of the current robotic research challenges include:

- Developing the software needed to enable the cooperative behavior of large numbers of robots to accomplish collective tasks.[23]
- Developing the software technologies necessary to enable inter-robot communications to support collective behaviors.[24]
- Developing computational strategies that are compatible with a highly resource constrained environment.[25]
- Developing human interface strategies that support both tasking and query of the micro-robot collective.[26]
- Performing experiments to reliably assess the progress toward developing the missing software needed for the successful operation of large numbers of micro-robots.[27]
- Developing the theory and technology necessary to benefit from learning as a means of composing and refining control software for autonomous mobile systems.[28]
- Developing the theory and technology for symbiotic sensor interaction needed to enhance the perception and supporting the reasoning required for the real-time control of an autonomous mobile robot in a complex, dynamic, unstructured environment.[29]
- Developing a uniform set of evaluation criteria needed to evaluate the autonomy quotient (AQ) of an autonomous mobile robot.[30]

Supporting the development of the Future Army concept includes other DARPA projects such as the Next Generation Internet (NGI) Program[31] for near instantaneous message flow among unmanned weapon platforms; the Distributed, Network System Program that shall oversee the battlespace of deployed unmanned weapon platforms, and the Control of Agent-Based Systems Program that shall impersonate man's intelligence.

DARPA's research projects shall be tomorrow's innovation in autonomous weapon platforms. Continued research by academia, businesses, laboratories and DARPA help further the advancement of studies in behavior and artificial intelligence, learning and neural networks, evolutionary algorithm, fuzzy logic, intelligent agents, internet and increased bandwidth, storage of and accessibility of data, information and knowledge, which will eventually produce a machine of intelligence for use on unmanned weapons platforms. Discoveries in these study areas over the next 15 years are likely to be ones of which we can now only conceive.

TERMINOLOGY

> *Like water, this rising tide of data can be viewed as an abundant, vital and necessary resource. With enough preparation, we should be able to tap into that reservoir – and ride the wave – but utilizing new ways to channel raw data into meaning information. That information, in turn, can then become the knowledge that leads to wisdom.*
>
> — Lester Alberthal, Jr.
> Former CEO, EDS Corporation

Before revealing strategic recommendations to integrate knowledge management initiatives for the Future Army, one must understand data, information, and knowledge in the context of integrating technologies in data management, information management, and knowledge management.

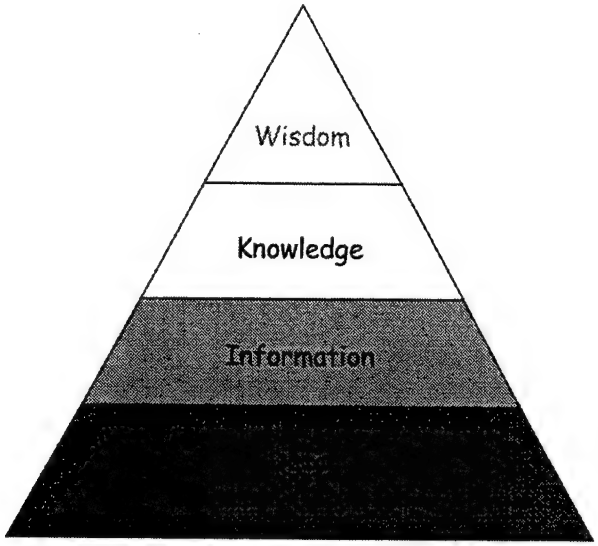

FIGURE 5. WISDOM TRIANGLE/PYRAMID

For simplicity, this paper utilizes the "Wisdom Triangle/Pyramid," a similar representation that's depicted on the Army Knowledge Online Public Homepage.[32] The first and lowest level of this triangle represents data. Large quantities of raw data and statistics are made available from numerous sources. At this level, data means very little and is often characterized by several stacks of computer printouts that no one has time to research or use. Data are

objective facts describing an event without any judgment, perspective, or context.[33] Words by themselves, or even numbers, are simply data.

The level above data denotes information. Information appears readily understandable as a term, but it is quite difficult to give an exact meaning. Information stands somewhere between data and knowledge, and essentially is a message. This informational level characterizes someone sifting through the raw data to add analysis and interpretation with which to place raw data into meaningful groupings and categories. Such actions may produce some discernable patterns or situations that were not previously apparent. It draws data together putting them in context, adds perspective to change people's minds or reinforce their beliefs.[34] Data is transformed into information in five ways:[35]

- Contextualized: Data gathered for a particular purpose.
- Categorized: Data organized into key components.
- Calculated: Data analyzed mathematically or statistically.
- Corrected: Errors removed from the data.
- Condensed: Data summarized into a concise form.

Information is data changed and vested with meaning and significance, just as musical notes are data, the order that a composer places these notes creates information, or music.

Based on the information gathered, one is able to begin work with some actionable information. As one sifts further, drawing on individual experiences and examining relationships with other information, information is converted into the third level, knowledge. Knowledge is a coherent structure that is slowly built up from separate bits and pieces of information. Defining knowledge is a question that has vexed both philosophers and theologians. Knowledge is importantly different from information. It is one step further along in the transformation process. When one receives a huge amount of information from facts and experience, one must evaluate this information to see, from it all, what can be known. If information is raw food, some digestion needs to have occurred for it to become knowledge. Knowledge is information laden with experience, truth, judgment, intuition, and values; a unique combination that allows individuals

and organizations to assess new situations and manage change.[36] Experience is the essential bridge between what happened in the past and what is happening in the present.[37] Truth is the critical understanding that bridges the gap between objectives and results.[38] Judgment is the ability to make sense of a situation that is completely unfamiliar.[39] Intuition is that unconscious decision maker born of experience and refined through trial and error.[40] Values dictate the ways in which we determine what is important and test actions.[41]

The top level symbolizes wisdom. Wisdom is perhaps even more difficult to define than knowledge, but if knowledge is a step further than information, then wisdom is a step further than knowledge. Wisdom implies having lived with knowledge for some time and understanding more deeply some of the problems and difficulties which some areas of knowledge can bring. The goal of any organization is to reach this top level. In the long run, the Future Army will achieve the top of the Wisdom Triangle/Pyramid, but it must first mature in the management of data, information, and knowledge, of which this paper is dedicated to.

THE KNOWLEDGE STRATEGY

> *Today's world is in the whirl of accelerated change in all domains. Old theories and foundations are dying and the new are not yet invented. Management leaders are living in the dark as to what strategies will make them successful. Exclusive focus on the short term does not enable a vision of the future.*
>
> — Dr. Eunika Mercier-Laurent
> Founder of EML Conseil-Knowledge Management, France

During an interview with Dr. George Kozmetsky,[42] he claimed that "the U.S. military is using 20th Century technology and its current plans continues to struggle with the use of antiquated technology." Throughout the 21st Century the Army will continue to be in transition. Those who say that the future of the Army is now are actually satisfied with the way the Army will progress with today's technology. The vision for the Future Army must go beyond reality.

CREATE A GRAND VISION FOR ARMY KNOWLEDGE

One of the best practices in business today is Sharing Knowledge. Although the persistent practices of reengineering, downsizing and mergers are today's norm; the move to become a Knowledge Organization encourages business survival. Knowledge must first be identified, captured, prioritized, organized and created before sharing it within an organization. The discipline of knowledge management, which is "a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into actions in ways that strive to improve organizational performance,"[43] could be attempted. However, future technology advancements dictate the variety of uses of ever-increasingly powerful computers that will automate processes and functions of man, a quest by many research scientists to produce a human machine.

The grand vision foretells a continuous, gradual systems transformation from manual to semi-autonomous to full autonomous modes of operation. To create a grand vision for Army knowledge is to automate what can be automated in the preservation of the warfighting knowledge for soldiers and for use in current and future weapon platforms.

Integrate Visions Among Subordinate Agencies

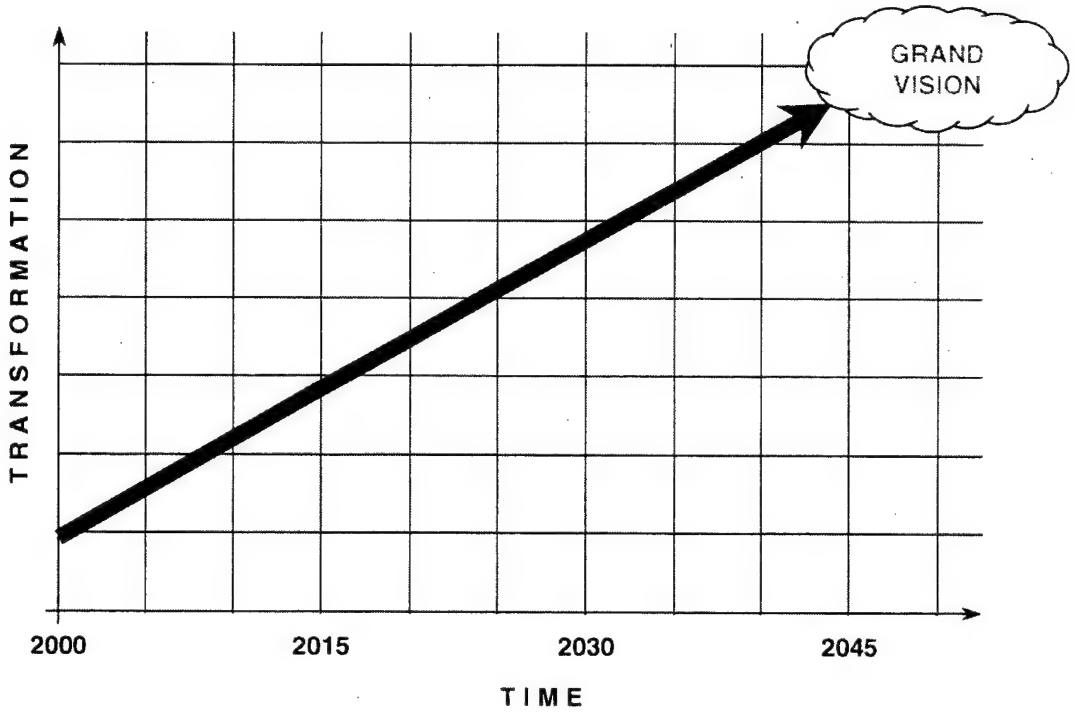

FIGURE 6. FORWARD-LOOKING APPROACH

Research accrued reveals the use of a common two-dimensional time-line chart predicting the direction an organization needs to take in the future, a Forward-Looking Approach (Figure 6). The critical fallacy in this standard illustration is that in all large organization, each subordinate agency, department or unit is involved in predicting its own direction for the future to justify its existence. For example, the Army is an extremely large organization with many subordinate agencies, departments and units. Who is watching over these agencies, departments and units to ensure that each vision now contains new goals which parallel the Army Chief of Staff's new vision? The existence of many of these individual agencies is a by-product of the programs that were approved due to an earlier Army Chief's vision. Their future existence now depends on what programs will be approved via future budgetary proposals that parallel the new Army Chief's vision.

What happens when the subordinate agency, department or unit reaches its predicted point in time, whether it accomplished its mission or not – create another new vision? All organizations, large or small, should follow a grand vision that's fifty years in the future, and if subordinate levels create their vision, it too, must have goals that extend towards this grand vision.

Redirect an Organization's Direction from the Grand Vision Perspective

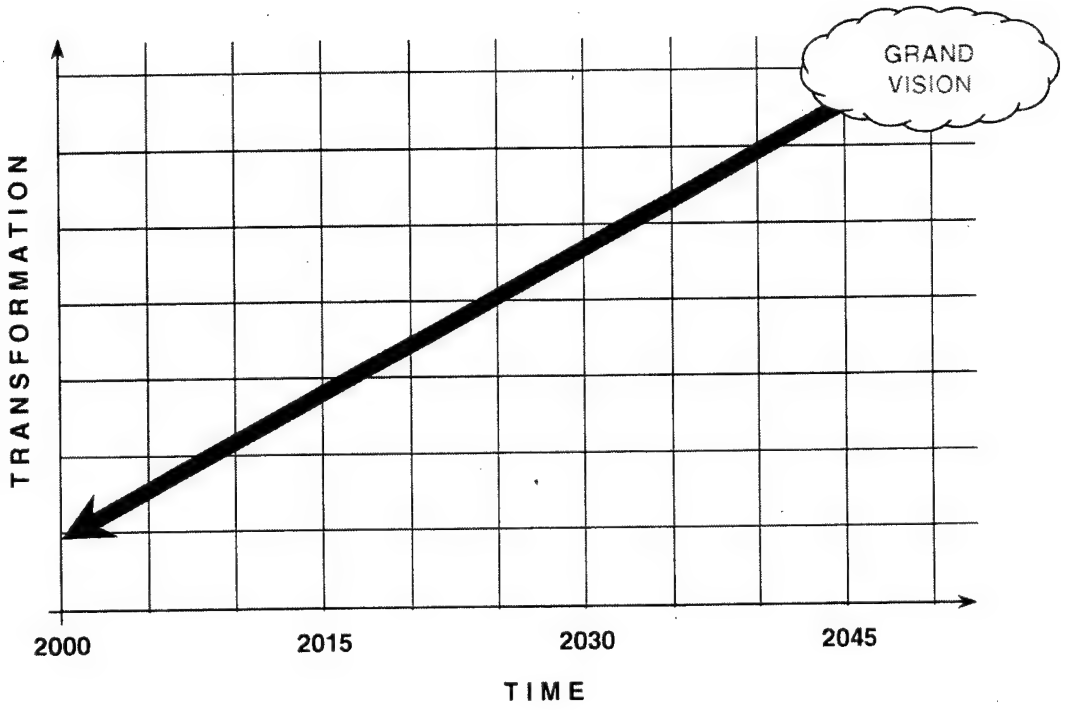

FIGURE 7. LOOKING-BACK APPROACH

Dr. Kozmetsky recommends that, instead of determining whether an organization is proceeding towards its vision, the organization should look back from its vision perspective to bring that fuzzy goal (dream) to the present, a Looking-Back Approach (Figure 7). Similar to the backwards-planning method, this is a brilliant way of pulling the organization towards a grand vision that's fifty years from present. For example, technology is changing faster than ever before, making it difficult to keep military information technology (IT) managers in the Army.

The Army Reserve has considered the possibility of contracting out IT management functions. This short-term focus does not facilitate any long-term Army goals, which introduces a conflict of interest issue. Will contract employees provide for the vision of the Army Reserve or the vision of the company they represent? An agreement with a defense contractor is for a finite period. If the Army Reserve considers implementing this short-term Forward-Looking Approach, recovery will take years to redirect the course it is following, a situation similar to organizations that tend to forge forward, not knowing if they are heading in the right direction (Figure 8).

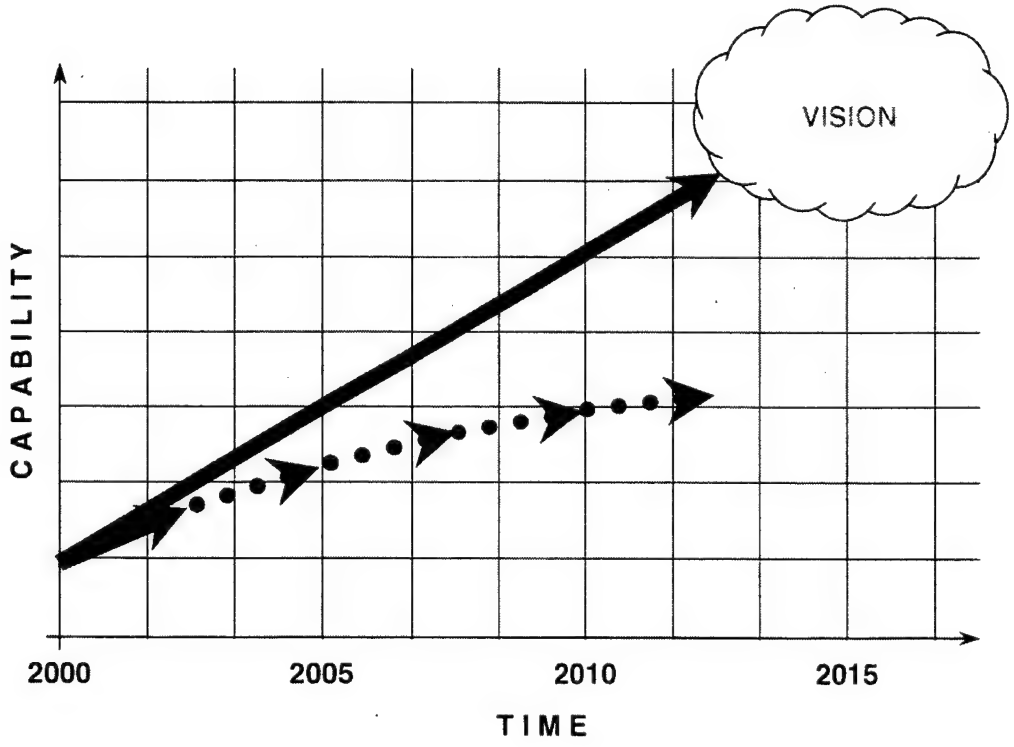

FIGURE 8. FORWARD-LOOKING APPROACH IN THE WRONG DIRECTION

The Future Army will always be in transition, and senior Army leaders must ensure that the Army remains manager of its own management functions. Disciplined to adhere to the vision of the Army Chief of Staff, Army leaders are biased to the long-term health of the Army. Army leaders should use Dr. Kozmetsky's Looking-Back Approach, whereby course corrections may be implemented immediately if an interim vision leads off the intended path (Figure 9).

External forces, such as budgetary cuts or Congressional mandates, can cause delays leaving the path towards a grand vision, but may be adjusted in time for proper course correction.

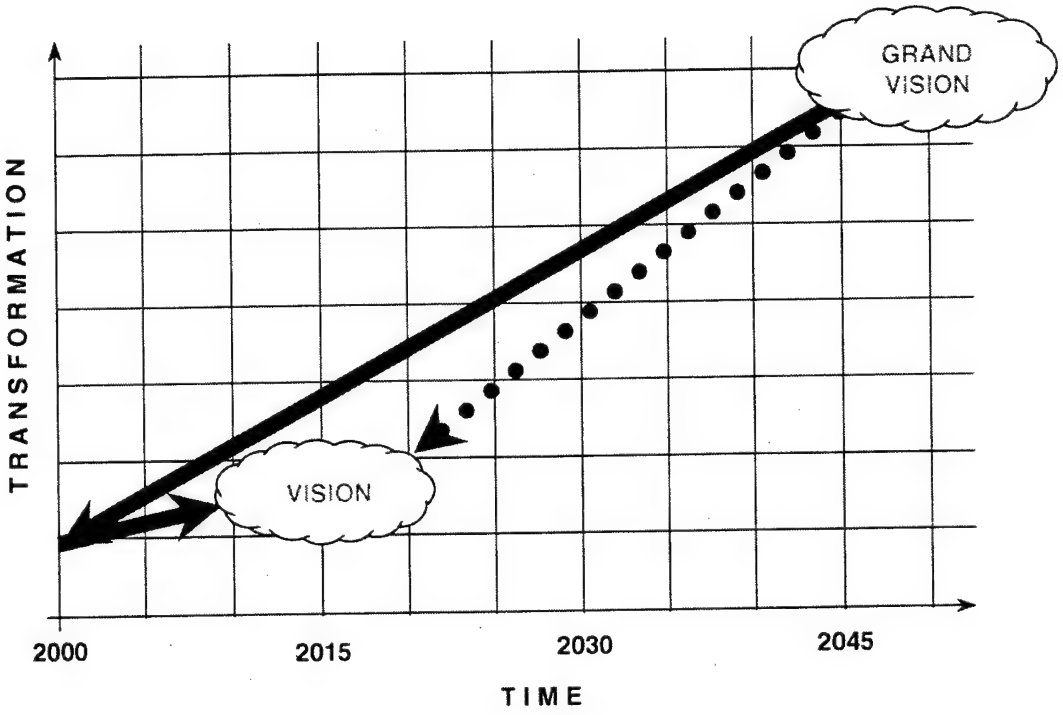

FIGURE 9. REDIRECT FROM THE LOOKING-BACK APPROACH

ADAPT AN ARMY WISDOM PYRAMID IN THE ARMY'S INFRASTRUCTURE

This paper does not suggest a complete overhaul of the entire Army infrastructure, but a gradual transformation as technology evolves. Relating to the Wisdom Triangle/Pyramid as a three-dimensional figure, this paper introduces the facets of an Army Wisdom Pyramid. Each of the facets should cover general areas that must be adapted for the Future Army to become a knowledgeable organization. The facets of the Army Wisdom Pyramid are Transformation, Configuration, Levels of War, and Six Army Imperatives.

FACET ONE: Transformation

The Evolving Technology section presented a glimpse of future expectations resulting from current research studies. The direction of these technologies exemplifies man's quest to produce a human machine. It is this grand vision that is beyond reality, and the Army fails to strategically include the paradigm shift from manned to unmanned systems occurring in the research environment for developing autonomous weapon platforms. Today – as the Army loses soldiers to a flourishing job market, as worldwide peacekeeping missions broaden, and as the Army switches to a strategically lighter force – the knowledge of fighting in a conventional war slowly diminishes. The Army must fill this void as technology shifts towards autonomous operation of unmanned weapon platforms. As the Army slowly loses its expertise due to retention problems, personnel cuts and retirements, it must inevitably use automation from evolving technology to its fullest. The transformation process for the Future Army concept from manual systems to automated systems must be addressed with the application of the basic Wisdom Triangle/Pyramid (Figure 10).

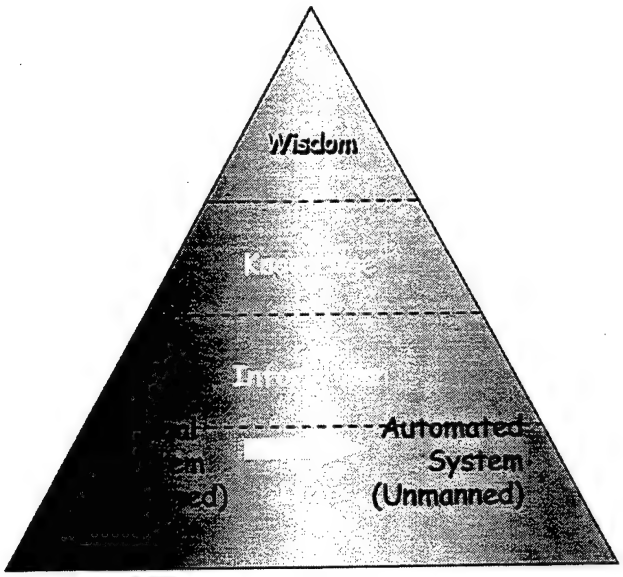

FIGURE 10. TRANSFORMATION

As noted, the vision for the Future Army must go beyond reality. It will be a full system of systems transformation as mission and technology continue to change. This transformation affects every level of the Wisdom Triangle/Pyramid. The Army must understand and analyze data, information and knowledge requirements for use on each weapon system as the system mutates from its current form of either manual or semi-autonomous to full autonomous modes of operation.

FACET TWO: Configuration

Configuration, in this context, is a management process; just as software development requires a configuration management process. Data, information, and knowledge must filter through this process. Knowledge must be identified, captured, prioritized, organized, created and shared within an organization. Before the establishment of knowledge, information must first be identified, captured, prioritized, organized, created and shared. Even before the occurrence of any information, data must also be identified, captured, prioritized, organized, created and shared. Thus, each level of the Wisdom Triangle/Pyramid must undergo a

configuration management process that will leverage evolving technology to improve the Army's effectiveness in all modes of operations as autonomous weapon platforms evolve (Figure 11).

Relationships among entities, whether it is between man and another man, man and machine, machine and another machine or a combination of all, shall be identified in this process. The sharing of data, information and knowledge will not transpire unless the correct association and proper linkages are established. Relationships run vertically as well as horizontally on each level of the Wisdom Triangle/Pyramid. The understanding of data as input for information, or the understanding information as input for knowledge is part of the over configuration management process. Relationships must be identified, captured, prioritized, organized, and created via a configuration management process before data, information and knowledge are shared.

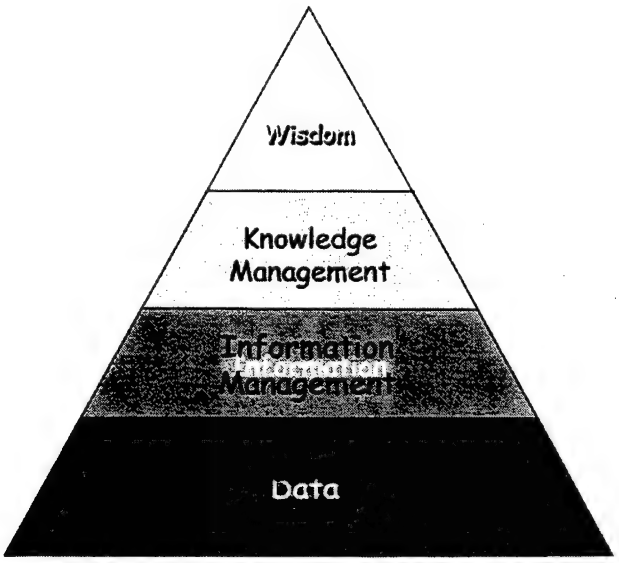

FIGURE 11. CONFIGURATION

FACET THREE: Levels of War

Referring to Figure 12, leaders want flexible systems that can be quickly modified to reflect changes in the *strategic* level of war. Demands for these systems require accurate data, information and knowledge to quickly affect a strategic course or correction. Employing the

military with the other instruments of national power to secure strategic goals require that they be accessible as well. At the *operational* level of war, leaders want to ensure that all systems are integrated for ease in maintaining and controlling. Integrating the various weapons platforms requires that necessary data, information and knowledge need to be identified and coordinated. The performance of joint and combined forces in major operations to accomplish the strategic objectives of higher authority depends on smooth circulation of data, information and knowledge. Therefore, proper design, well-established organization and fully functional integrated data, information and knowledge structures will help the Future Army to conduct its strategies, campaigns, major operations and battles swiftly and victoriously. At the *tactical* level of war, leaders are concerned with the pace and continuity of any given operation. The data gathered and the information received must both be accurate and quick for the planning and execution of battles and engagements.

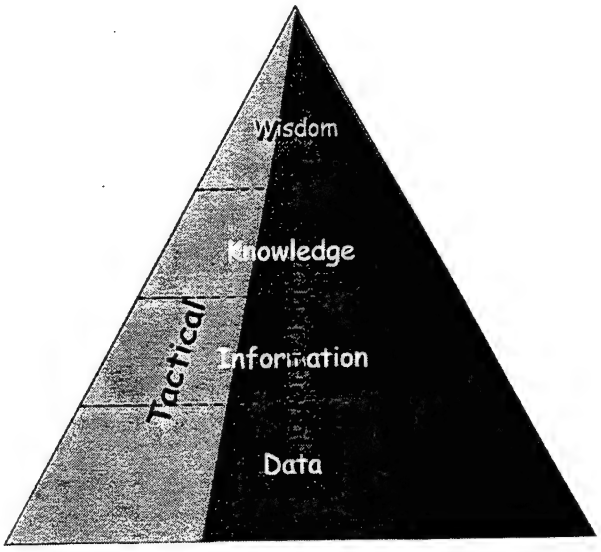

FIGURE 12. LEVELS OF WAR

The Persian Gulf Campaign lasted 100 hours. With the creation of this facet of an Army Knowledge Pyramid, future conflicts may ultimately conclude in less than 100 minutes. Data, information and knowledge will traverse rapidly among integrated, future unmanned weapons

platforms, that it will be very difficult to distinguish the division among the three levels of war. The President, for example, may some day issue specific national security goals and the entire Army infrastructure will commend strategic, operational and tactical objectives at a near-instantaneous pace.

FACET FOUR: Imperatives

Applying the six Army Imperatives in the development of a knowledgeable Army outlines the core competencies essential for the continuous shift from manual to automated systems (Figure 13). Although "*quality* entails attracting and retaining high-quality soldiers,"[44] the future Army must expand beyond the soldier and towards technologies, which identifies a new challenge in man's quest to produce a human machine. Soldiers are the Army. In time, machines that think and learn will be part of the Future Army and should be scrutinized now.

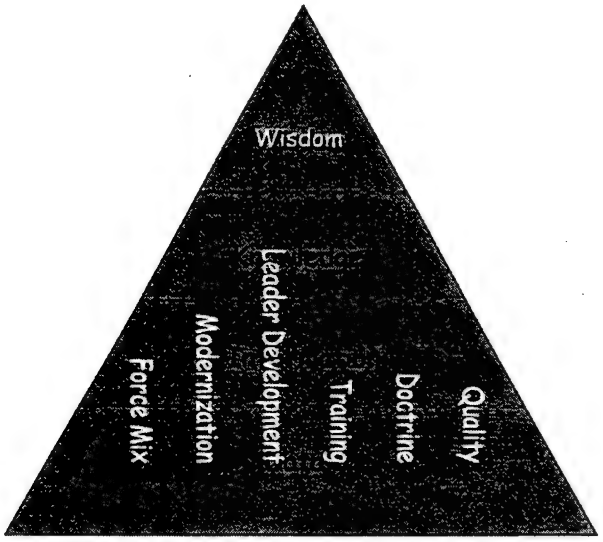

FIGURE 13. IMPERATIVES

Likewise, future Army *doctrine* should be analyzed today as evolving technology influences the transformation towards unmanned weapon platforms. As fully autonomous weapon platforms become a reality, new military doctrine must be considered, for example, "the art of sacrificing" in a game of chess. The first nine fundamental rules for the opening, listed in

Table 1, and the ten rules for the middle game, listed in Figure 2, are doctrinal chess rules that provide general guidance in the conduct of war. Rule 10 in Figure 1 cautions the use of sacrificing. Sacrifice rules, listed in Figure 14, can be learned by anyone. The concept here is the use of unmanned weapon platforms "sent to the slaughter," rather than sacrificing the life of an American soldier.

REAL SACRIFICES

1. Sacrifices for Development.
2. Obstructive Sacrifices.
3. Preventive (or Anti-castling) Sacrifice.
4. Line-Clearance Sacrifices.
5. Vacating Sacrifices.
6. Deflecting or Decoy Sacrifices.
7. (Castled) King's Field Sacrifice.
8. King-Hunt Sacrifices.

SHAM SACRIFICES

1. Positional Sacrifices.
2. Sacrifices for Gain.
3. Mating Sacrifices.

SACRIFICIAL VALUES

1. The Exchange Sacrifice.
2. The Queen Sacrifice.

FIGURE 14. TYPES OF SACRIFICES IN CHESS[45]

Training and *leader development* will continue as long as soldiers are in the Army. The knowledge gained from current "digitizing the force" programs, should assist in the learning process for future young leaders, and in the application of future unmanned weapon platforms' learning process, if implemented correctly. "The Army will push more responsibility and authority to lower levels. This will require junior leaders to learn and practice leadership and management skills before associated with mid- and high-level leaders."[46] As the Army delegates to its lowest level, it must also consider the same push towards unmanned weapon platforms. The Army should redirect its emphasis on the activities involving operational data, information and knowledge at the Center for Army Lessons Learned, if sharing across the Army is to be effective.

Army *Modernization* shall persevere as long as new technologies continue to evolve. Additional Army research and development emphasis in the studies of behavior and artificial intelligence, learning and neural networks, evolutionary algorithm, fuzzy logic, intelligent agents, internet and increased bandwidth, storage of and access to data, information and knowledge, must progress to produce intelligent machines on unmanned weapon platforms. The Army should leap beyond the mere exploitation of today's technology and keep abreast with this future innovation. Tomorrow's technology will be the conduit for sharing knowledge not only among soldiers and its future generations, but also among unmanned weapon platforms integrated together to share knowledge (of the battle situation, terrain, courses of action, and threat information) in achieving a commander's objective on the battlefield or to secure national security objectives.

Current Army modernization programs do not remove man completely from weapon platforms, but evolving technology will. The removal of man shall lead to the Army saving billions of dollars on human factors engineering and considerations, i.e., no environmental shelters, crew compartments, placement of personal gear to contend with, and no ergonomics. Innovative designs can make systems traverse over any type of terrain. Just as the concept of the current Family of Medium Tactical Vehicles (FMTV) with its many variants, the possibility of a common weapon platform base for use by any combat arm branch should be considered in future Army modernization program.

The balance between peacetime and preparation for a conventional conflict must be addressed in the *force mix*. As the future moves toward the development of thinking and learning machines, the Future Army will eventually be equipped with unmanned weapon platforms that think and learn autonomously. Integrating the use of these machines must be studied today before unmanned weapon platforms become a true reality.

The current challenge to create a lighter, strategically mobile force fills the void brought about by the expectation of increased operations against transition states, rogue states, failing

states, and transnational outlaws. As soldiers power project to serve in harsh worldly missions, the expectation for a conventional conflict becomes passé. If the Army is to keep abreast with evolving developments for full autonomous weapon platforms, today's concentrated efforts should be on identifying, capturing, prioritizing, organizing, creating and sharing of data, information and knowledge.

EXPAND INITIATIVES FOR MANAGING DATA

As a society, we are buried in volumes of data that are recorded electronically, and people's access to it is ever increasing. Students, researchers, analysts, businesses, even the casual home Internet users are experiencing a "data overload" syndrome. To provide for data accessibility without overloading the user, data must be managed in a simple, standardized way. The management of data involves identifying, capturing, prioritizing, organizing, creating and sharing data. Evolving database technology describes a new way of thinking about data.

Developing an Army data architecture with standards and guidance to identify, capture, prioritize, organize, create and share data should be established by a centralized Army agency or organization. Today, the Army maintains various types of databases in functional usages like personnel, intelligence and security, combat operation, logistics, test and evaluation, and weapons and equipment development. Expanding towards data warehousing techniques and technologies help create an integrated data architecture that will provide flexibility in accessing organization-wide information and tools to process information. A data warehouse structures data in a relational way, making it easier and more effective to manage, access, and analyze.

Simple access to many existing Army databases is not readily achievable. If the Army implements data warehousing techniques and technologies, a strategic plan should be imposed on replacing legacy database systems. One acceptable migration path is utilizing the data hub approach.[47] This approach would create a hub (portal) unraveling any direct links among each database system to easily isolate and replace critical legacy systems in today's unarchitected and non-standard data environment. Figures 15, 16, 17 and 18 respectively show the sequence of events as the data hub replaces each direct link among legacy databases. Standalone databases, without any linkages to other database systems, would simply connect to the hub. The hub presents a suitable connector to link responsible users. A linkage to this hub promotes data sharing between users and any database system on this portal.

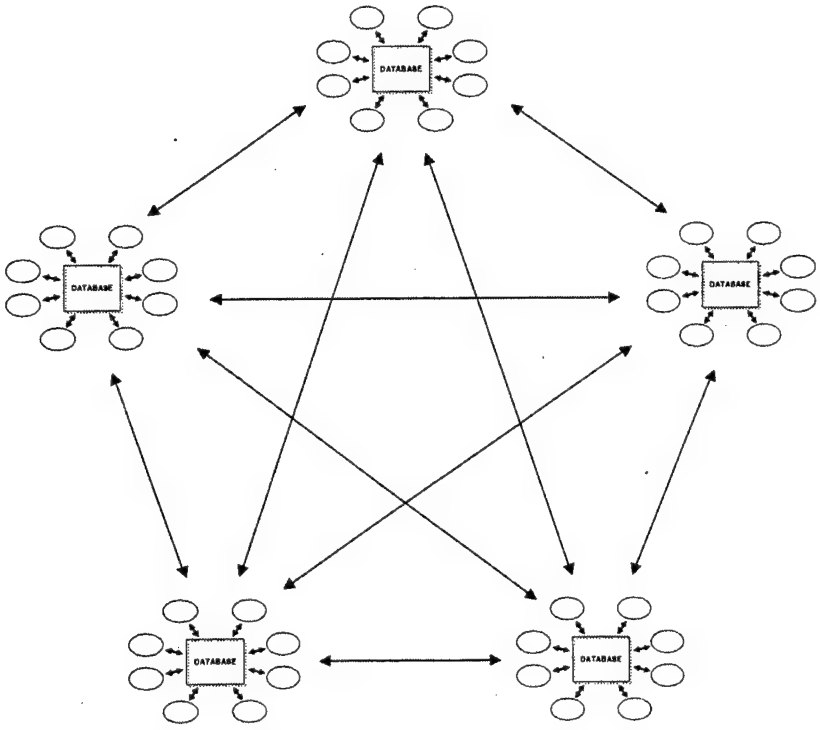

FIGURE 15. NO HUB CONNECTION

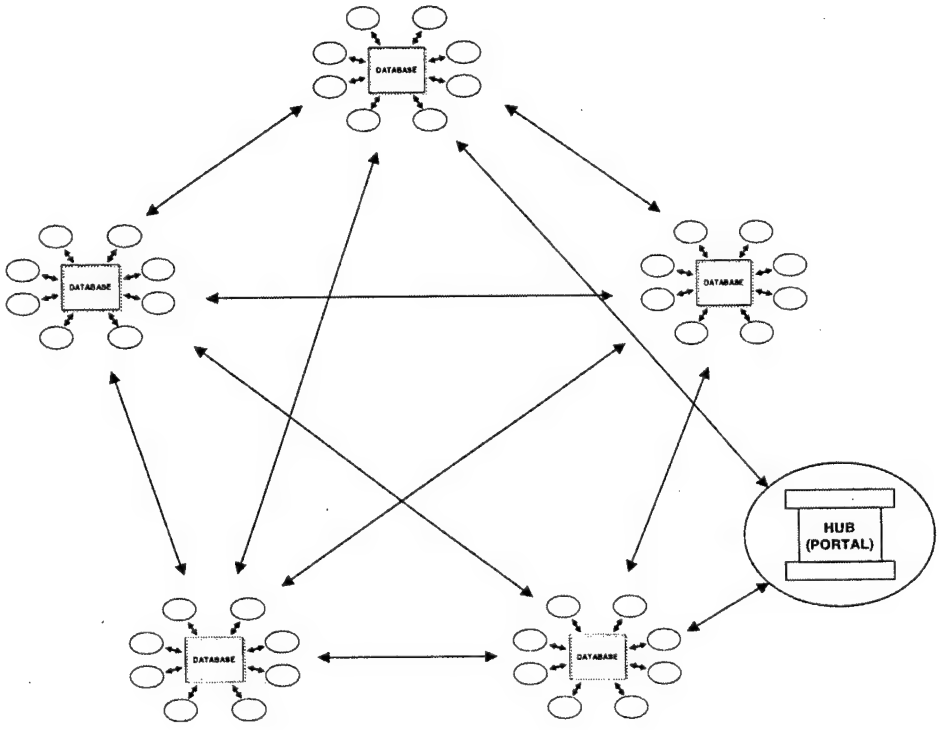

FIGURE 16. HUB CONNECTED TO TWO DATABASES

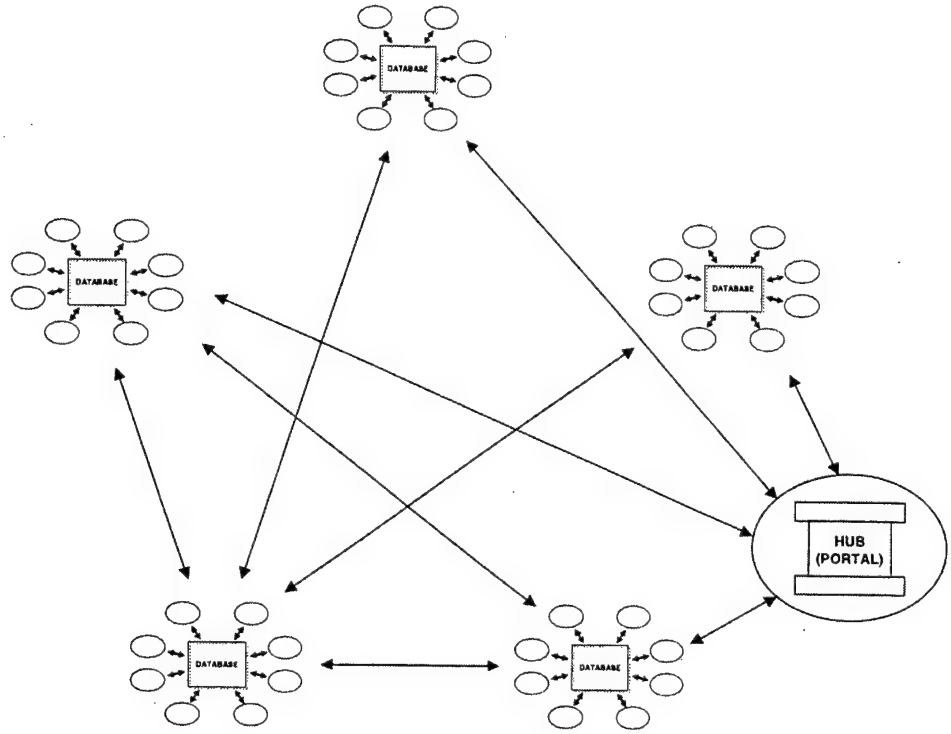

FIGURE 17. HUB CONNECTED TO TWO MORE DATABASES

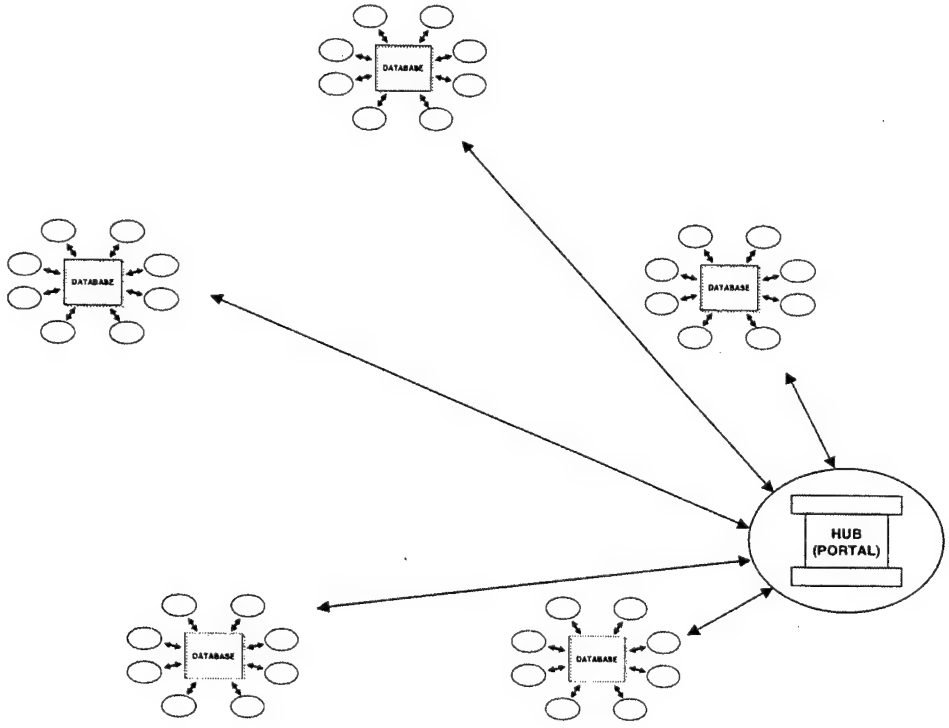

FIGURE 18. HUB CONNECTED TO ALL DATABASES

One clear example of an unarchitected data environment is the Army National Guard Bureau's 54 different personnel databases, representing the 50 United States and its territories. Another example is the personnel databases for the Active, Reserve and National Guard; none of the databases are integrated. Every Army organization from company level to division or corps level should have a data repository system that is part of an Army-wide data architecture. Whether implementing a data hub approach or a newly established database or warehouse, a data architecture with standards and guidance to identify, capture, prioritize, organize, create and share data help prepare any organization in managing information, the next level of the Army Knowledge Pyramid.

How much data must an organization collect? Data does not become information until someone analyzes it. As noted earlier, information is data changed and vested with meaning. Not one person can provide an intuitive answer to this simple question, so the solution is to collect everything. The existence of future unmanned weapon platform depends on data it will access for its specific tasks or mission.

In looking beyond reality, the Army should begin plans on managing data for the development of leadership profiles to be imbedded into semi-automated or automated weapon platforms. The Army has been using personality guides, like the Myers-Brigg Type Indicator or the PROFILER to build relationships in a group environment that deal with change. Data of leadership profiles should be the dynamics for creating decision support systems that provide options for battle preparation.

For starters, the Army can develop an internal electronic mail address protocol whereby the structure of this new format replicates the military command structure from company level to division or corps level. This new address protocol should make units and positions represented within units easy to identify. After these messages are captured, organized and created for further analysis, it can be shared among others in studying decision-making processes of a

commander or his staff. These electronic messages already stored on government servers become permanent records[48] as back-up operations are conducted nightly.

For years, the Army Research Institute (ARI) instituted studies to automate staff functions using data collected from various Battle Command Training Programs (BCTPs). ARI should expand its studies using profile data of a commander and his staff. With the Army's modernization strategy embracing digitization, ARI should be the lead player in collecting these profiles as units begin learning and participate in the integration process of a digitized battlefield.

All Army personnel serving in the military should be issued two separate e-mail addresses, a military account for the unit of which the soldier is assigned and a personal account issued at time of Army induction. For example, the current Assistant Deputy Chief of Staff for Operations Plans in Force Development is Major General Joseph M. Cosumano, Jr. His electronic mail address set up on a government server would then be:

Duty: ADCSOPS-FD@odcsops.pentagon.army.mil

Personal: JMCosumano@army.personal

The former address would remain with the organization; the latter would follow MG Cosumano throughout his Army career. Developing an e-mail address protocol yields enormous possibilities in embedding decision-making and staff coordination processes in future Army decision support systems (DSS) and decision systems (DS) for use unmanned weapon platforms.

Standards, like the address protocols above, does help create a manageable data architecture of official electronic messages that easily identify the position within a unit or agency for studying staff actions or a scheme to produce a repository of leadership profiles. Emphasized at Headquarters, Pacific Command's Crisis Action Team, the U.S. Navy uses a "pass-down" log whenever a service member completes a watch or shift. In their system, when a soldier completes his or her term of duty, the relief must have data of the actions performed of

his or her predecessor, else the service member risks his next action through guesswork or on trial and error methods.

However, a standard duty e-mail address format would provide this basis for that replacement to seek, for example, the history in the conduct of an earlier staff action or a decision action administered by his or her predecessor. The idea of Headquarters, Pacific Command's "pass-down" log procedure can be expanded using this standard duty e-mail address format during permanent change of station of permanent party members.

Separate electronic address formats should help control the enormous influx of messages received over official e-mail addresses. The present e-mail address format promotes the free "flow of communication and exchange of ideas to take place with lightening speed,"[49] and has caused the unfortunate use of the military chain of command structure for informal means of communication. Policies or even directives, like the one issued by Command Sergeant Major Alex R. Lackey, U.S. Army Reserve Command Sergeant Major, advising "using the chain of command" are needed, but may not truly curb the problem, especially with an e-mail address protocol which does not parallel the military chain of command structure. Implementing this dual electronic address account should prevent soldiers from bypassing the chain on official channels and promote the use of the personal account as the unofficial or informal communication medium. This recommendation also prevents an informal message on the personal account from becoming a governmental record.

Managing data is only the first layer of the Wisdom Triangle/Pyramid. An Army-wide data architecture using data warehousing techniques and technologies must be emplaced for standards application and assured guidance in data management. It must be the vehicle, which establishes accessibility, and a foundation to permit data sharing. Proper data management makes it easier and more effective to manage, access and analyze information.

EXPAND INITIATIVES FOR MANAGING INFORMATION

Information is data changed and vested with meaning and significance. If recorded data in a data warehouse is managed for ease of access and analyses, an organization can begin transforming data into useful information. However, transforming data into information requires human attention, i.e., those who use it can only identify useful information. Therefore, an organization must be selective in identifying, capturing, prioritizing, organizing, creating and sharing information. An organization that must manage information, must also manage the relationship between the user and the information the user extracts.

In order to survive, organizations use elaborate information management systems to manage their valuable information. With the arrival of data warehouse techniques and technologies, information management systems have advanced to become decision support systems (DSS), providing the speed at which to extract categorized data and assist an organization in making swift appropriate decisions. With continued advancements in Decision Theory, Bayesian Analysis, Multiple-Criteria Decision Making, Linear Programming, Game Theory, Integer Programming, Markov Analysis, and Dynamic Programming, decision support systems will progress to decision systems (DS).

The nation expects military professionals as individuals and the Army as an institution to learn from the experience of others and apply that learning to understanding the present and preparing for the future.[50] The Center for Army Lessons Learned has created a vast repository of operational information. For example, many of the staff functions listed and explained in Field Manual 101-5 can be automated via programmable instruction sets. Advancements in software intelligent agents, which automatically gather information according to a profile established and maintained by the user, can improve Decision Support Systems, which aid staff officers in making recommendations for the commander and contribute to mission success. It is important that the Army increase its emphasis and support in studying the relationships among staffs,

units, weapon platforms and commanders during the current digitization process at Fort Hood, and that the information resulting from this study is managed and maintained at the Center for Army Lessons Learned for future accessibility upon the advancements towards Decision Systems.

"Digitizing the Force" today is considered a step ahead by the military, but the conversion process has been implemented too late. Air Defense Artillery was the first branch to digitize its operation, specifically the command and control (C2) function. During the late 1970s, the AN/TSQ-73 (Missile Minder), U.S. Army Air Defense Artillery's finest-built C2 system, exemplified a formidable step ahead in air battle management of Hawk, Nike Hercules, and later, Patriot fire units. Information was shared near instantaneously among units to provide the necessary air defense coverage to offset their radar clutter and terrain masking. With the speed of threat aircraft carrying precision ordnance, survival of a fire unit and the priority assets that the fire unit protects depends on timely information. As the Army digitizes its current force, lessons could have been learned during the replacement activities of the antiquated AN/TSQ-38 C2 system (Missile Monitor) with the Missile Minder (if any information existed).

Standardization of the Army Tactical Data Link 1 (ATDL-1) message formats and protocols made the Missile Minder a triumphal success during its life expectancy in countering the speed of threat aircraft. The Army should standardize as much as possible data link message formats and protocols for information sharing among systems. Any standardization process requires a dedicated configuration management process. As the current Army transforms itself, a devoted configuration management team involving every player (from the developer to the contractor to the respective Army branch) must be identified to succeed in "Digitizing the Force."

The presence of the Missile Minder in the 1980s bridged two of the three levels of war, operational and tactical. As technologies continue to evolve and advancements are made to manage near-instantaneous information, the three levels of war will be very difficult to

differentiate or separate. Information will flow freely from strategic to tactical, just like a chess player who conducts a strategic game plan through simple tactical moves. Unfortunately the Army reinvented its wheels nearly 20 years too late, but it should continue digitizing to shorten the gap in implementing future technology. Both data and information derived from this transition process must be precisely and appropriately managed for a timely and smooth adaptation towards the acceptance of unmanned weapon platforms.

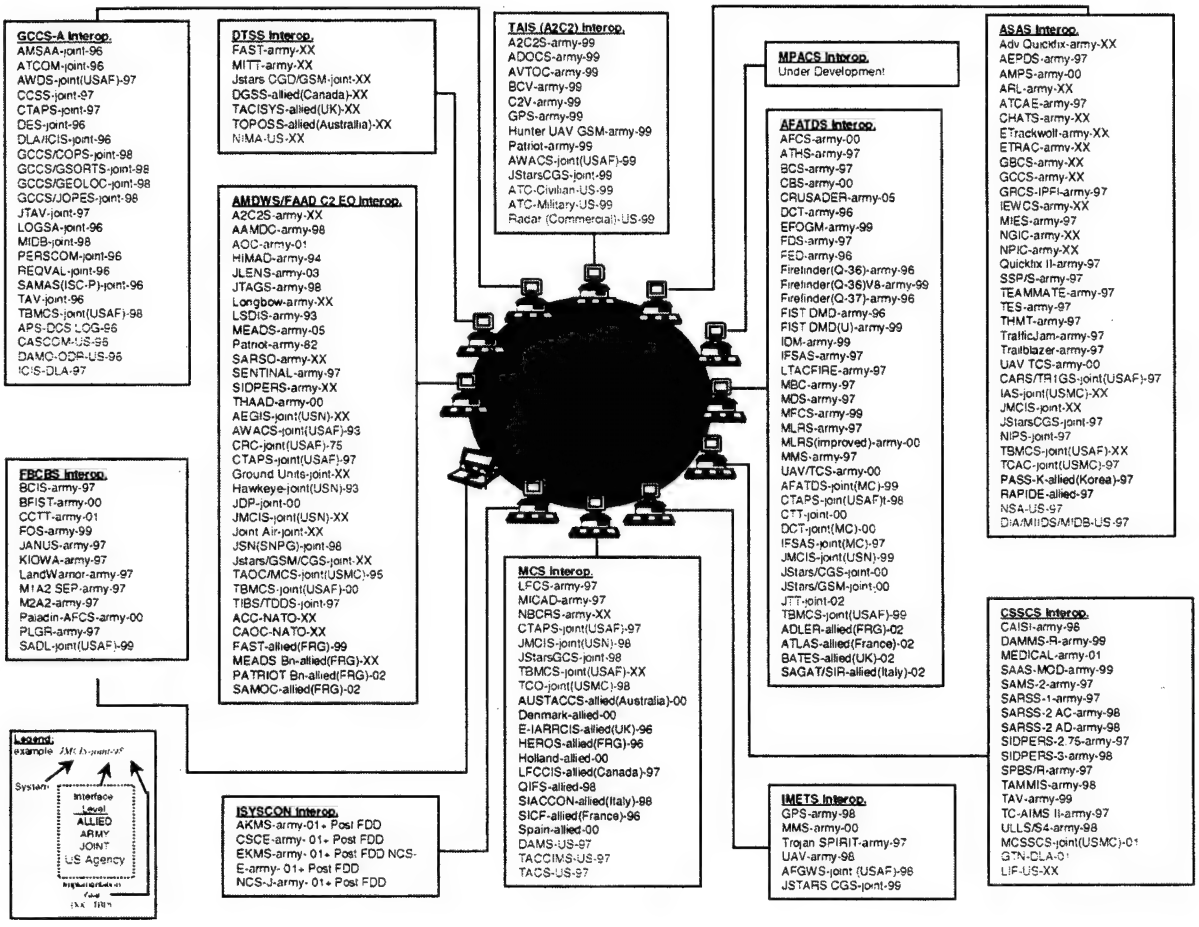

FIGURE 19. ARMY BATTLE COMMAND SYSTEMS EXTERNAL INTEROPERABILITY[51]

Digitization is the application of information technologies to acquire, exchange, and employ timely information throughout the battlespace.[52] The Digital Force Coordination Cell (DFCC) located at Fort Hood has the distinct mission to digitize the 4th Infantry Division (Mech), 1st Cavalry Division, 3rd Armored Cavalry Regiment, and III Corps. Information among the

various Army Battle Command Systems (ABCS) may not be easily accessible and transferable because of different and unique operating systems, dissimilar message formats or protocols, or system incompatibility and antiquity. Implementing the hub approach (as described earlier) to connect a multitude of systems, such as those shown in Figure 19, might be a timely endeavor, but it is a simple approach in the sharing of information. Relationships among these systems must be identified early if information is to be shared and transferred among manned, and in the future, unmanned weapon platforms.

One of the lead contractors for the military has been doing the same. Lockheed Martin (LM) has identified the need to improve interoperability among all of its developed systems: Combat Terrain Information System (CTIS), Defense Message System (DMS), Global Transportation Network (GTN), Maneuver Control System (MCS), Advanced Tomahawk Weapons Control System (ATWCS), All Source Analysis System (ASAS), Theater Battle Management Core Systems (TBMCS), Air Force Mission Support System (AFMSS), Global Combat Support System - Air Force (GCSS-AF), and Warfighters Simulation 2000 (WARSIM). This major internal research and development initiative is called Project Rainbow.[53] The Future Army must fight "joint" to win. It will be using existing Joint and Coalition systems developed by Lockheed Martin. Although the information management initiative of integrating LM's developed systems is an internal Lockheed Martin project, the Army should monitor LM's progress, possibly learn from LM's interoperability issues and approach, or share lessons learned from "Digitizing the Force" programs with LM.

As the Army digitizes its force and moves towards the use of decision support systems to aid a commander and his staff in making decisions, these DSSs will eventually evolve into decision systems when the Army includes full autonomous weapon platforms. To prepare the Army for the transition from decision support systems to decision systems, the Army should begin studies and data collection activities of commanders and his staff as they use decision support systems. Results of these studies should feed into the evolution of decision agents,

which automatically gather information according to a profile established and produce decisions appropriate to the battle situation and in accordance to the commander's intent. From this, the profile of a commander and his capable staff will someday lead to a repository of tacit knowledge.

Today's Internet has provided researchers, analysts, students and business organizations a medium to acquire information. The city of Austin is fast becoming a national leader in some of the hottest, fastest developing industries, like computers, software, semiconductors, telecommunications, multimedia and bioscience. Seeing this market niche, *ibooks.com* began providing the Austin market with service to build a personal virtual bookshelf. A customer would log on, request reference materials, purchase the books, and place these items in a personal account that automatically creates a bookshelf. The customer does not worry about his reference materials being recalled by a librarian; the information is available to the customer at any time of the day or night; and accessible via the Internet. This extremely brilliant concept could be applied to the Future Army, i.e., reference materials organized by the soldier in his own virtual bookshelf. If a service member were to be issued a personal e-mail address account throughout his Army career, issue him a personal virtual bookshelf account. Training materials for military occupational specialty (MOS), references on assigned weapon or weapon systems, or reading material for military schools becomes his. When a soldier relocates, is deployed, or assigned to a school, he literally travels light without hauling around professional books. The Army should look into the services provided by *ibooks.com*, as growth potential and the application information sharing.

Sharing or exchanging information synergizes relationships within an organization. As organizations strive to manage information by selectively identify, capture, prioritize, organize, create and share information, it does so by managing the relationship between user and the information the user extracts. Properly managing information make it easier and more effective to manage, access and analyze knowledge.

EXPAND INITIATIVES FOR MANAGING KNOWLEDGE

Knowledge is a strategic resource for any organization. To build organizational knowledge, data and information must first be managed. Maturity in managing both data and information precedes the development of organizational knowledge. Knowledge is information laden with experience, truth, judgment, intuition, and values; a unique combination that allows individuals and organizations to assess new situations and manage change."[54] Knowledge, like data and information, must be identified, captured, prioritized, organized, created and shared. In sum, knowledge must be managed.

One of today's Army knowledge initiatives that should be financially supported is the newly conceptualized University After Next Program. UAN, as it is called, is the brainchild of two individuals working at the Center for Army Lessons Learned at Fort Leavenworth, Kansas. While serving in their Army Reserve capacity to provide emerging knowledge needs for the Army After Next, Antonio P. Monaco (Program Manager, UAN) and James H. Ritter (Operations Chief, UAN) conceived of this virtual organization, University After Next. UAN was designed as a distributed organization, composed of three components: Distributed University, Distributed Library, and the Distribution Laboratory.

The first component is a "distributed system of schools and various centers of knowledge" that, when combined, serve as a University, the ultimate seat of knowledge.[55] The purpose of this University is "to create a next-generation learning environment that supports the soldier, leader and unit in any and every way possible to support their mission."[56] The second component is a system that "provides integration and synchronization of the wide range of existing virtual and distributed information sources across the Department of Defense (DoD), academia, business and other governmental agencies."[57] The purpose of this Library is "to provide an accessible depository to an extensive body of knowledge."[58]

> A wealth of knowledge resides in the students, staffs and faculties of various schools and combat training centers across the Army. UAN will create a

> seamless network of subject matter experts. These subject matter experts can act as an extended staff that will investigate, research and explore specific, high priority issues and provided solutions and recommendations through Command, Control, Communications, Computer Intelligence, Surveillance, and Reconnaissance (C4ISR) systems to the commander on the ground.[59]

The third component is a system that uses the Defense Information Technology Testbed to "explore, identify, catalog and exploit the research and development efforts conducted across DoD, academia, business and other government agencies."[60] This Laboratory "looks for and identifies trends across current, emerging and future technologies"[61] that may be inserted in the other two UAN components.

The Army must expand its capture of organizational knowledge. Organizational knowledge consists of explicit, tacit and cultural knowledge, and new initiatives to capture this knowledge must be attempted. Since 1985, the Center for Army Lessons Learned (CALL) continually attempts to share explicit knowledge to soldiers worldwide, and has done a superb job in its continuing expansion to automate the capture, archiving, and digital dissemination of photo, video, and audio media.[62] The convenience of the Internet provides users information from various CALL products:[63] virtual newsletters; special studies; handbooks of training techniques; real world operations; book reviews; and training videos (to name a few). The Center for Army Lessons Learned has provided links to other service schools and incorporated joint publications. However, it needs to further its operations technologically for the capture of explicit knowledge, i.e., more than what it maintains now for use in unmanned weapon platforms or simulations. Explicit knowledge is easier to collect because it conveys rule and procedures. The value of capturing explicit knowledge provides the necessary input for intelligent agents, which will be embedded in future decision systems and decision-based systems of unmanned weapon platforms.

Tacit knowledge on the other hand is not easy to collect because it is difficult to verbalize implicit knowledge, but a repository of leadership profiles should be attempted. Successful and unsuccessful Army leadership personalities of today and yesterday should be studied, just as

vast studies have been conducted on Clausewitz and Napoleon. The usefulness of this endeavor is likened to kids or adults playing an arcade computer game. When they play *Street Fighter Alpha 3* by Capcom, Co. Ltd., they can select from a list of profile fighters (like Balrog, Gan, Ryu, Sakura or Zangrief) to do combat with or against.[64] The matching concept here is foreseeing the results of a battle simulation upon which a leadership profile was selected. Some of the selected profiles[65] would be General George S. Patton, Colonel Joshua L. Chamberlain, CPL Alvin C. York or even Field Marshal Erwin Rommel, to determine or compare possible outcomes.

DoD has used various types of proven personality-trait studies to help organizations in managing change or managerial skills to enhance effectiveness. Myers-Brigg Type Indicator (MBTI), with its 16 different personality types, helps participants enhance their interpersonal skills to increase the productivity of teams or work groups. The objective is to familiarize employees with different personality types and the application of personality-type theory to self-improvement, working in teams, and managing conflict. With over 30 years of research, PROFILOR has help organizations put the right candidates in key roles, develop high potentials for increasing responsibility, and provide individuals with a strong base for development. Results of MBTI and PROFILER have proven successful for DoD. The Army could expand on these results to embed into software intelligent agents the profiles of leaders. This initiative to manage implicit knowledge may begin after a soldier takes the oath of allegiance. When a soldier becomes a leader (or a commander) and his decision-making processes are collected throughout his Army career, a confidence level is built and developed to insure that unmanned weapon platforms will adhere to his personal intent of a battle situation. Although today's technology is not ready to handle this, an effort to prepare the Army for this knowledge initiative should be planned now.

The third part of organizational knowledge is cultural knowledge, which is the values and norms of the organization. Cultural knowledge for the Future Army entails a transformation

process. As explained in an earlier section, the Army will move from manned to unmanned weapon platforms, a transformation that is inevitable. If the U.S. Army Training and Doctrine Command (TRADOC) intends with its Military History program – to demonstrate that all decisions, ranging from personal conduct to the future of the Army, are influenced by the past in some way[66] – then it should take the lead in identifying, capturing, prioritizing, organizing, creating and sharing cultural knowledge. Currently TRADOC's U.S. Army Center of Military History oversees the Army Historical Program. The Military History Institute at U.S. Army War College – which interviews veterans as part of its historical research collection to preserve heritage and traditions of American's regular, volunteer and militia land forces – should continue its work closely with TRADOC's historians and museologists and the Center for Army Lessons Learned at Fort Leavenworth, Kansas,[67] to assist in the managing of cultural knowledge.

Adapting to change is difficult, but armies throughout history have learned that failure to adapt can be disastrous. The Army has a number of significant challenges ahead -- both technological and cultural -- that they should begin developing and implementing solutions for tomorrow. Every soldier possesses some type of knowledge. For basic soldiering, a Command Sergeant Major mastered this qualification through more than 28 years of experience. For leadership, a general officer with more than 22 years of service possesses this trait. Experience equates to some type of organizational knowledge.

ESTABLISH DISCIPLINES FOR THE KNOWLEDGE MANAGEMENT FORCE

A Knowledge Management Force must be established to assist the Office of the Director of Information Systems for Command, Control, Communications, and Computers (ODISC4) in building an Army Knowledge Infrastructure. The purpose of an Army Knowledge Infrastructure is knowledge sharing. This infrastructure must be flexible internally and accessible externally. The mission of a Knowledge Management Force is to manage the first three levels of the Army Wisdom Pyramid.

For the data level, the Army should establish a Data Manager discipline that shall support the organization in identifying, capturing, prioritizing, organizing, creating and sharing data. The soldier awarded with this discipline shall be responsible for making data available to end users through efficient data organization and access management. With standardization, this discipline shall replace legacy systems via the data hub approach and shall direct the link among database systems using data warehousing techniques and technologies to make it easier and more effective to manage, access and analyze. This discipline shall require the collection of all data that will have usefulness in the future. The purpose of this discipline is to work with ODISC4 in creating a data structure for the organization. The structure shall be simple and built with standards set forth by ODISC4 to prepare an organization for managing the next level, information.

For the information level, the Army should establish an Information Manager discipline that will support the development of software intelligent agents to improve decision support systems that aid a commander and his staff in making decisions, and the development of software decision agents for incorporation into autonomous, automated weapon platforms. The soldier awarded with this discipline shall emphasize relationship within an organization for the exchange and sharing of information. Being part of the organization, this soldier shall conduct requirement analysis in the use of information. Working with Data Managers, this discipline

shall take the lead in identifying, capturing, prioritizing, organizing, creating, and sharing information, as the Army transforms itself from manned to unmanned weapons platforms.

For the knowledge level, the Army should establish a Knowledge Manager discipline. As noted, knowledge must be identified, captured, prioritized, organized, created and shared, just like data and information. However, this discipline must take the lead in capturing organizational knowledge (i.e., explicit, tacit and cultural knowledge). The concept in this discipline is to automate knowledge that can be automated with evolving technology advancements. Rules and procedures that can be programmed shall be automated to maximum extent possible. Working with Data Managers and Information Managers, "knowledge awareness" is the purpose of this discipline. The soldier awarded this discipline must be a visionary supporting the future growth of a Knowledgeable Army as it migrates to the use of unmanned weapon platforms.

The Army has system automation officers designated with a Functional Area (FA) 53 discipline, and given various titles, such as Information Management Officer, Data Base Manager, Information Systems Manager or Automation Management Officer. Earning an FA 53 designation requires an educational degree in one of the following areas, Information Systems Management, Computer Science Engineering, Telecommunication Management, Computer Science, Computer Engineering (Artificial Intelligence) or Systems Engineering. FA 53 was recently converted into the Army Acquisition Corp to accommodate the expansion of information management and information technology for the Knowledge Age.

The Army should establish three variants of a common Functional Area that parallel the levels of the Army Wisdom Pyramid: A *Data Manager* variant to manage data and promote data management initiatives; an *Information Manager* variant to manage information and promote information management initiatives; and a *Knowledge Manager* variant to integrate data, information and knowledge technologies for the acquisition process, the testing process, the transformation process from manned to unmanned weapon platforms, and the Joint Military

Strategic Planning process. Basically, a knowledge manager influences full participation in every Army organization, to reduce redundancies (of data, information, and knowledge) at all levels. These related and synergistic variants of a Functional Area shall assist ODISC4 in building a Knowledge Infrastructure for the Future Army.

With today's recruiting and retention problems, budget cuts and downsizing, the Army must use its existing force structure to manage knowledge. A Command Sergeant Major (CSM) exists in every command or agency. This senior enlisted member can assume the role of a Unit Knowledge Manager. A CSM normally has the most time in service and is the highest enlisted member in a unit. Supporting the vision of his commander, a CSM's leadership capabilities are unquestioned for ensuring that organizational knowledge is properly managed and appropriate actions taken to reduce redundancies. Although not a technical person, but under the auspices of a certified Chief Knowledge Officer (CKO), ample guidance can be provided.

The Army today does not have CKOs; although, a few Chief Information Officers (CIOs) exist. The only certificate program known within the Department of Defense is sponsored by the DoD Chief Information Officer and awarded by the Information Resources Management College under the National Defense University. During a recent interview, Dr. Robert E. Neilson[68] recognized that the 21st Century is an epoch of the Knowledge Age and has begun the framework for a CKO curriculum, a course of instruction that corresponds with the current CIO Certificate Program, focusing on the ten Federal CIO competencies. The Army should support the proposed Knowledge Awareness initiatives of Dr. Neilson's as he promotes a unique and formidable education program. Developing Army CKOs necessitates the Army's eventual transformation to use unmanned weapon platforms.

Establishing disciplines for a Knowledge Management Force will insure that data and information lead towards a path of maturity in the quest for a Knowledgeable Army, and that initiatives to build a Knowledgeable Army are not diverted from the Future Army Concept presented in this paper.

SUPPORT A MILITARY TAX INCENTIVE PROPOSAL TO RETAIN ARMY KNOWLEDGE

Congress should provide a military tax incentive for all service members, including retirees, for the purpose of retaining their Army knowledge. As the Senate and House Armed Services Committees oversee the nation's military establishment, they authorize Pentagon's spending for research, development, and procurement of weapons systems; construction of military facilities; and civilian and uniformed personnel. Although these two Congressional committees sanction retention and recruiting incentives, Congress, as a whole, has the explicit constitutional duty to declare war, to regulate foreign commerce, to raise and support military forces, and the power to raise taxes. This strategic proposal must move beyond these Committees that provide for short-term fixes in maintaining comparable wages of soldier to the civilian sector, and showing that a long-term investment by the entire Congressional delegation in retaining Army knowledge effectively protects the overall national security of the U.S.

The leaders of knowledge organizations fully realize that their most important assets walk out their door every night. Whether those assets show up the next day is of vital importance to the future of any knowledge organization. If Army leadership is to build a Knowledgeable Army, so, too, must they retain and recruit its most important assets, soldiers. For today's younger generation, serving in the military is no longer a career enticement. Competition from a surging economy exacerbates the problems for Army recruiters working 65-hour weeks in their pursuit of a shrinking supply of high school students who are not even considering a military alternative after graduation. In his final State of the Union Address, President Clinton proposed to make four years of college affordable for all. Pell grants, student loans, education IRAs, and HOPE scholarships have already benefited 5 million young people, and yet millions of families still strain to pay college tuition. He proposes a $300-billion opportunity tax cut, in the form of a middle class tax deduction for up to $10,000 in college tuition costs. Competition from state government incentives, which have even spent billions building up vast community-college

systems, giving millions more high school graduates access to post-secondary education, have worsen military recruiting efforts. If this continues, by 2015, there may not be an Army to fight two simultaneous major regional contingencies. It would be like starting of a chess game with a player missing all his Pawns on the board, a requirement to conduct the end game.

Proposals, such as the President's $300 billion opportunity tax cut to make a four-year college education affordable, invite competition against the needs of the military with the increasing threat of losing an element of national power. Military personnel are subject to involuntary assignments any place in the world, often on short notice, often to places of grave danger. Service members are subject to searches and command inspections in living quarters that would not meet the privacy standards and warrant requirements of the fourth amendment that citizens take for granted in civilian society. The basic nature of military service is preparation for the participation in combat to defend the interests of the United States. This tax exemption on wages must extend to military retirees. After retirement, service members remain a strategic resource for the Army and can be recalled for their inherent knowledge. The U.S. may someday require their knowledge and expertise.

With 2000 being an election year, all service members, including retirees, should persuade their respective Congressmen to maintain its national power by investing in a tax incentive proposal. The proposal should take the form of a new amendment to the U.S. Constitution that service members and retirees are exempted from federal income taxes of all wages earned while serving in the military. This amendment is a national investment that solidifies the existence of a ready Army for use in times of peace or war.

Napoleon deserted his military twice: once, in his North African campaign and the other, in his defeat against Russia. Will the Congress and the American people desert the men and women of their armed forces? The U.S. must keep patriotism alive by investing in the knowledge that all (active, reserve and retired) service members' retain. This military tax incentive is an investment for the security of this nation.

A FUTURE COMPARISON

> *Not to promote war, but to preserve peace by intelligent and adequate preparation to repel aggression...*
>
> —Elihu Root

SCENARIO 1: IMPLEMENTING THE KNOWLEDGE STRATEGY

The year is 2010, and the U.S. military power projected around 45 deployments since the Berlin Wall was torn down in 1990. In the first decade of this 20-year period, military operations throughout the world lent itself to tremendous usage of active Army units and uninterrupted rotation of Guard and Reserve units for 34 contingency deployments. President George W. Bush's personal loyalty to the military and the enormous backing of the American public,[69] pummeled members of Congress who supported the Globalization concept,[70] and lead to decreased national commitments during the second half of this 20-year period.

President William J. Clinton, in his final term in office, presented the concept of Globalization to the 106th Congress, a perception that favored some Congressional members, but the Executive Branch under two-term President George W. Bush helped preserve the Army's integrity by supporting the concept of building a Knowledgeable Army with the employment of unmanned weapon platforms during the initial stages of a conventional conflict or war. General Eric K. Shinseki, Army Chief of Staff, correctly envisioned in 1999 the creation of a light and highly deployable force to protect vital U.S. interests abroad against transition states, rogue states, failing states, and transnational outlaws that prevented the repeat of a "hollow"[71] Army. From the time the 107th Congress unanimously voted for the addition of a new Amendment to the Constitution, which exempted all military basic pay for those who serve in active, guard or reserve capacity, and retired status, retention and recruitment problems started to diminish. A nominal 3% increase in military pay across the board was authorized and appropriated by Congress per year.

One of the lessons learned from Strategic Crisis Exercise 2000[72] is not to disperse all military forces to meet worldwide commitments of a political agenda. Despite the downsizing that occurred in 2001, the Army executed the opposite – spreading its force thin to keep up with perpetual worldwide commitments. In 2008 – with the help of Congress, the President, and the American public[73] – the Army introduced the first unmanned multi-variant artillery and tank weapon platform, known as the K-1 (for Knowledge 1).

The advancements in robotics and artificial intelligence from Massachusetts Institute of Technology and Carnegie-Mellon University, and key innovations in pulsed power, hypervelocity physics and electrodynamics, and electromagnetic launch conducted at the Institute for Advanced Technology, University of Texas at Austin under the leadership of Dr. Harry D. Fair, lead to the Army's modernization effort at producing an ultra-light, strategically deployable, technologically awesome weapon platform for conventional wartime usage. Like a chess game, these variants would be deployed first in setting up the beginning and middle fight. The Army did not require much time to build up its forces in confronting any small regional conflict.

"Digitize the Force" programs were an accurate guess that paid off dividends for the Army in the Knowledge Age. All types of data were collected (personnel, intelligence and security, combat operation, logistics, test and evaluation, and weapons and equipment development) for use in decision systems. Breakthroughs in intelligent agents' development lead to full autonomous weapon platforms. Man was completely removed from the multi-variant weapon platforms, that human factors engineering was not a consideration for ergonomics.

A test of the Army's modernization effort occurred in the summer of 2010. North and South Korea united and became the new Republic of Korea. This action infuriated the leaders of the People's Republic of China (PRC) that a new demilitarized zone (DMZ) appeared between the former North Korea and PRC border. China built stealth technology into their ground and air weapon platforms.[74] "U.S. companies sold the Chinese special materials that help make planes like the stealth fighter invisible to radar."[75] The easing of trade restrictions

with China ten years ago hurt U.S. national security and President Clinton's trade policy has been influenced by campaign contributions from the Chinese government and from U.S. high-tech companies that do business with China.[76]

China decided to send one-third of its military forces across this DMZ and the Korean military forces (mostly from the former Republic of Korea) took a beating after swarms of Chinese in their stealth weapon platforms overran the peninsula. The U.S. Army did not have a forward presence. Implementing a force projection scenario of unmanned weapon platforms, in less than six hours, over three hundred unmanned artillery and tank K-1 platforms, each the size of a Volkswagon Beetle, were deployed into areas in the southern Korean peninsula. En masse, they thrusted ahead to retake the northern Korean peninsula. In less than 24 hours, the autonomous U.S. force was 100 miles beyond the DMZ chasing down stray PRC tanks.

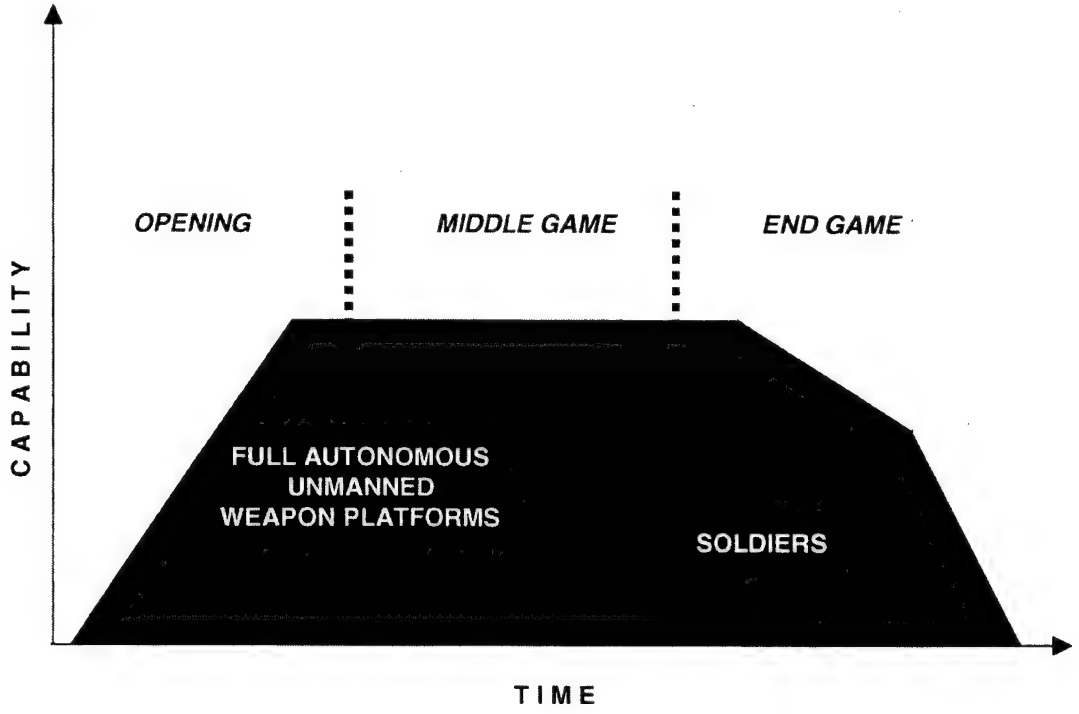

FIGURE 20. IMPLEMENTING THE KNOWLEDGE STRATEGY (CAPABILITIES VS. TIME)

Casualties occurred for about an eighth of the unmanned U.S. force, caused from the existing barriers emplaced during the former separation of North and South Korea. Like a chess

game, the unmanned K-1 weapon platforms set up quickly in the "opening" after their arrival in theater, and fought swiftly and collectively an admirable "middle game" through knowledge sharing of the battle situation among each other. No American soldiers were killed, as they did not arrive until the next day from other peacekeeping operations. Their presence meant assisting the Republic of Korea in clean up operations. An association between capability and time of this futuristic scenario is depicted in Figure 20. Notice that soldiers are introduced into the theater in the "middle game," and are ready to take care of business in the "end game." Support from Congress and the President to engage in integrating knowledge initiatives for the Future Army produces an optimum tool for national power – a Knowledgeable Army.

SCENARIO 2: BUSINESS AS USUAL

The year is 2010, and the U.S. military power projected over 85 deployments since the Berlin Wall was torn down in 1990. In the last decade, military operations have been maintained throughout the world lending itself to boundless usage of active Army units and the endless rotation of Guard and Reserve units. The United States economy had reached its apex and is now in its downward swing, as other nations like, Germany, Japan, and China, are growing at a tremendous two-digit Gross Domestic Production (GDP) rate. The Executive Office under two-term President Al Gore, the American public enjoyed prosperity at the cost of military defense. Despite huge manpower dollars to support a dwindling Army, no further gains in retention and recruitment resulted. Congress, with the backing of the President, decided to cut the active force in half and shift residual units to the Guard and Reserve.

During the first decade of the 21st Century, Globalization[77] continued. The focus in the 2000's was prosperity and stability of other nations than important national interests. The Globalization concept[78] of former President William Clinton continued during the reign of President Gore at the severe risk of sharing American ideas, goods and knowledge, with no other progress envisioned beyond 2010 in military research, development or modernization.[79] Army Chief of Staff, General Eric K. Shinseki, who created a light and strategically deployable force to protect vital U.S. interests abroad against transition states, rogue states, failing states, and transnational outlaws, was the only critical advancements made for the Army. Digitization of the force continued, but with less emphasis in managing[80] Army data, information or knowledge (in the area of personnel, intelligence and security, combat operation, logistics, test and evaluation, and weapons and equipment development) needed to build a Knowledgeable Army. The political agenda of Congress and the Gore administration stood steadfastly on investing in the struggle of other countries to develop and grow.[81]

The expansion of electronic commerce built a flourishing virtual market over the newly created Super-Internet (SI), which was capable of transferring data at speeds above the 25 Gigabytes per second. Electronic pets that mimic real pets were available over the SI. The Japanese were ahead in electronics. The Scandinavian countries were ahead in digital communications. The European countries were ahead in the studies of Knowledge Management. Nearly every nuclear-capable country actively participated in research and development involving robotics and artificial intelligence.

The future Army, which depended on the use of the Guard and Reserve units with increasing deployments to protect vital national interests abroad against transition states, rogue states, failing states, and transnational outlaws, brought discontent to the American public. Conducting missions involving operations other than war became the norm throughout the decade. The Army's ability and knowledge to fight a fast-pace conventional war was nearly non-existent. The Army became "hollow." Evidence shows that, during times of peace, the readiness issue of the U.S. military has always been questionable. No active (Army) divisions existed when the U.S. entered World War I.[82] When General Malin Craig became the Army Chief of Staff in 1935, he was greatly concerned about the state of the divisions and the long lead time required for improving military preparedness.[83]

This became prevalent during the summer of 2010. After years of famine, the former North Korea decided to follow the economic development of the West. Both North and South Korea unified. This action infuriated the leaders of the PRC that a new demilitarized zone (DMZ) existed between the former North Korea and PRC border. China was a manufacturing demon that built stealth technology into their ground and air weapon platforms.[84] "U.S. companies sold the Chinese special materials that help make planes like the stealth fighter invisible to radar."[85] The easing of trade restrictions with China ten years ago hurt U.S. national security and President Clinton's trade policy has been influenced by campaign contributions from the Chinese government and from U.S. high-tech companies that do business with

China.[86] The loss of the Panama Canal in 1999 to the Chinese, now threatened America's front door.

The U.S. Army did not have a forward presence due to numerous worldwide commitments. The world, especially the Chinese, learned from the Persian Gulf Campaign that do not give the U.S. military forces any time to build up. China decided to send one-third of its military forces across this DMZ and the Korean military forces (mostly from the former Republic of Korea) took a beating after swarms of Chinese in their stealth weapon platforms overran the peninsula. In a couple of days all of Korea was under PRC's control. The United States must now retaliate and recall its military forces spread around the world, plan to conduct beachhead assaults, and risk American lives to create a staging area for build up of forces on the peninsula. The rest of the scenario continues...

In comparison with the previous scenario, casualties would be far worse. The initial set up in the "opening" gave the Chinese the advantage to fight an extended "middle game." Figure 21 shows an association between capability and time for this futuristic scenario. Soldiers are introduced in the "opening," exposing the risk of losing American lives. The Army needed to redirect its focus as training in the last decade concentrated on worldwide commitments in operations other than war. The "middle game" would be extended with much energy exerted in breaking the will of the invading forces, as the remaining two-thirds of their militia stand ready from within Mainland China. Without support from Congress and the President to engage in integrating knowledge initiatives for the Future Army, one of the tools for national power may no longer be useful for it is business as usual.

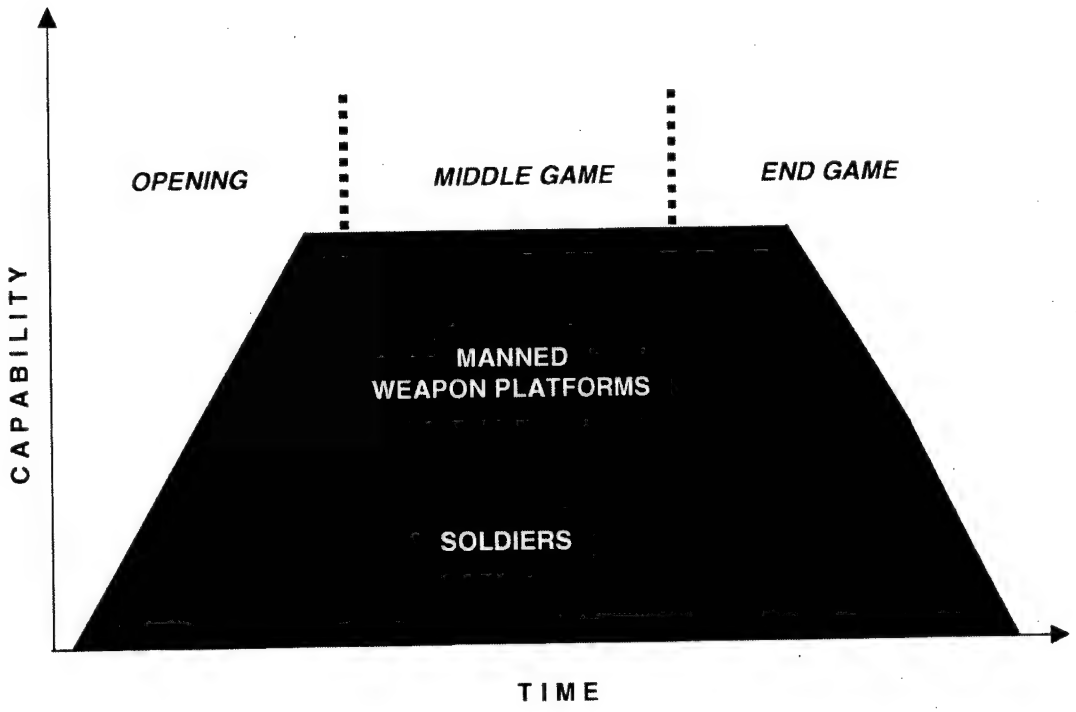

FIGURE 21. BUSINESS AS USUAL (CAPABILITIES VS. TIME)

CONCLUSION

If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

— Benjamin Franklin

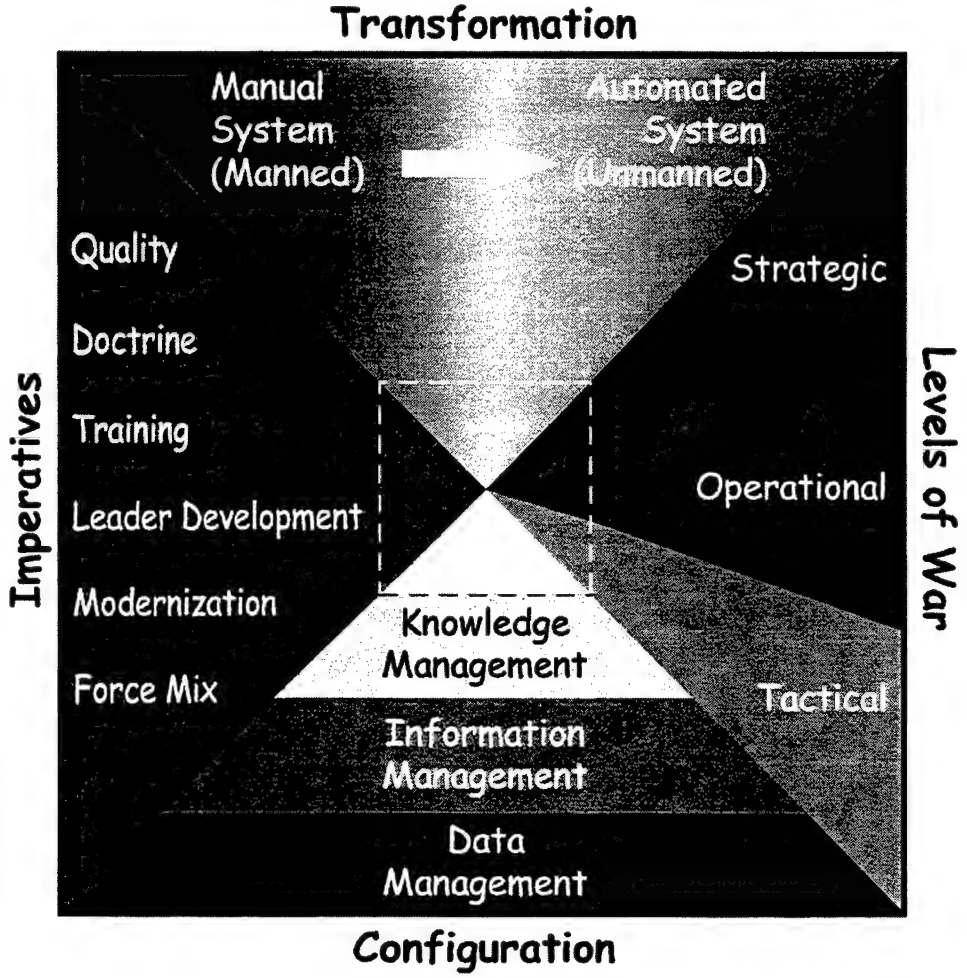

FIGURE 22. ARMY WISDOM PYRAMID

Knowledge is crucial for the existence of an organization, and one of the best practices in business today is sharing knowledge within the company/firm. A business must get the right knowledge to the right people at the right time. To share that knowledge, an infrastructure should be established. This paper introduced a Knowledge strategy based on the Wisdom Triangle/Pyramid concept. Using this Pyramid concept, one can formulate the facets. The

different facets of the pyramid must cover the general area for adapting an organization in becoming knowledgeable.

The Army should start by developing an Army Wisdom Pyramid. The facets of the pyramid must cover Transformation, Configuration, Levels of War and the Six Army Imperatives. Evolving technology exemplifies man's quest to produce a human machine, which implies a transformation from manned to unmanned weapon platforms. Each layer of the Wisdom Pyramid must go through steps in the management of data, information and knowledge. These steps are identify, capture, prioritize, organize, create and share. Proper data management makes it easier and more effective to manage, access and analyze information. Properly managing information make it easier and more effective to manage, access and analyze knowledge. Since knowledge is a strategic resource for any organization, it must also be managed. Develop a workable configuration management process to properly manage the bottom three layers of the Wisdom Triangle/Pyramid. The demand for accurate data, information and knowledge will be needed at each level of war. Each of the six Army imperatives must be adaptive as the Army shifts to autonomous weapon platforms.

Head towards a a grand vision that's beyond reality by implementing Dr. George Kozmetsky's Looking-Back Approach. Expand initiatives for managing data by changing legacy database systems through the use of data warehousing techniques and technologies and implementation of the hub approach. Use the hub approach as a portal to insert external databases. Establish two distinct electronic mail addressing protocols for separation, collection and controlling of formal and informal communications. Provide the soldier with a virtual bookshelf account. Expand initiatives for managing information in support of evolving decision support systems, which will eventually produce decision systems. Standardize message format to ensure smooth flowing traffic among all weapon platforms as they are integrated together. Support the knowledge initiatives of the University After Next program at the Center for Army Lessons Learned and begin planning for the management of organizational knowledge,

consisting of explicit, tacit, and cultural knowledge, for anticipatory developments in creating leadership profiles.

Establish a Knowledge Management Force that will assist the Office of the Director of Information Systems for Command, Control, Communications, and Computers in building this Army Knowledge Infrastructure, by instituting disciplines that represent the first three layers of the Wisdom Triangle/Pyramid. Seek other means at retaining long-term organizational knowledge via a proposed new amendment to the U.S. Constitution. Investment in the security of this nation is backed by the knowledge of all active, reserve, and retired service members. Exempt from federal income taxes all wages earned for those serving in the military.

"Business as Usual" should not be the practice for the future, but a visionary direction towards "Implementing a Knowledge Strategy." Rather than having soldiers fight a conventional war, the Army should exploit future technology, which leads to the development of full autonomous weapon platforms. Destroy the enemy's will to fight without exposing American soldiers. Integrating the knowledge management initiatives presented in this paper should build a Knowledgeable Army of awesome power. As the old saying goes – Knowledge is power!

ENDNOTES

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[8] Fine, 31.

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[19] Hans Moravec, "Rise of the Robots," *Scientific America*, December 1999, 126.

[20] *Ibid.*

[21] Defense Advanced Research Projects Agency website; available from <http://www.darpa.mil/>; Internet; accessed 26 January 2000.

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[23] "Challenges for Software for Distributed Robots;" available from <http://www.darpa.mil/ito/research/sdr/challenges.html>; Internet; accessed 26 January 2000.

[24] *Ibid.*

[25] *Ibid.*

[26] *Ibid.*

[27] *Ibid.*

[28] "Challenges for Mobile Autonomous Robot Software;" available from <http://www.darpa.mil/ito/research/mars/challenges.html>; Internet; accessed 26 January 2000.

[29] *Ibid.*

[30] *Ibid.*

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[34] *Ibid.*, 106.

[35] Thomas H. Davenport and Laurence Prusak, *Working Knowledge: How Organizations Manage What They Know* (Boston, Massachusetts: Harvard Business School Press, 1998), 4.

[36] An amalgam of several authors' attempts at defining knowledge, but most closely resembles that of Davenport and Prusak in *Working Knowledge.*

[37] Huseman, 108.

[38] *Ibid.*, 109.

[39] *Ibid.*, 110.

[40] *Ibid.*, 112.

[41] *Ibid.*, 113.

[42] Dr. George Kozmetsky, Chairman, Advisory Board and Senior Research Fellow, IC2 Institute, interview by author, 1 December 1999, Austin, Texas.

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[45] Rudolph Speilmann, *The Art of Sacrificing in Chess* (New York, New York: David McKay Company, Inc., 1951).

[46] Department of the Army, *Installation Management*, 1–4.

[47] Melissa A. Cook, *Building Enterprise Information Architectures – Reengineering Information Systems* (Upper Saddle River, New Jersey: Prentice Hall PTR, 1996), 172-176.

[48] "When are e-mail messages records? You should treat e-mail messages the same way you treat paper correspondence. An e-mail message is a record if it is related to DoD mission or business and if you or anyone else would need to retrieve the message to find out what had been done or to use it in other official actions." Taken from "It's In The Mail," an informational handout from the Information Management Course, Army Reserve Readiness Training Center, Fort McCoy, Sparta, Wisconsin.

[49] CSM Alex R. Lackey, USAR, "E-mail: No Substitute for the NCO Support Chain," *Army Reserve Magazine*, Spring 2000, 5.

[50] Department of the Army, *Army Leadership*, Field Manual 22-100 (Washington, District of Columbia: U.S. Department of the Army, 31 August 1999.

[51] Illustration provided by LTC Edward Milster, Deputy Director, Digital Force Coordination Cell.

[52] "Digitization" defined in an illustration provided by LTC Edward Milster, Deputy Director, Digital Force Coordination Cell; quoted in *The United States Army Modernization Plan*, 13 April 1998.

[53] Information provided by Antonio P. Monaco, Program Manager, University After Next.

[54] An amalgam of several authors' attempts at defining knowledge, but most closely resembles that of Thomas Davenport and Laurence Prusak in *Working Knowledge*.

[55] "The University After Next," Informational Handout from the Inaugural Component Forum Distributed Research Library (DRL) University After Next (UAN), 15-17 November 1999, Lawrence, Kansas.

[56] *Ibid.*

[57] *Ibid.*

[58] *Ibid.*

[59] Information provided by Antonio P. Monaco, Program Manager, University After Next, Fort Leavenworth, Kansas, from a "University After next Concept and Update for the U.S. Army Board of Directors" Presentation given on 26 September 1998.

[60] "The University After Next," *Ibid.*

[61] *Ibid.*

[62] "A Brief History of CALL," Center for Army Lessons Learned, Fort Leavenworth; available from <http://call.army.mil/call/homepage/history.htm>; Internet; accessed 2 April 2000.

[63] "Center for Army Lessons Learned Products," Center for Army Lessons Learned, Fort Leavenworth; available from <http://call.army.mil/call/homepage/product5.htm>; Internet; accessed 2 April 2000.

[64] Capcom Entertainment website; available from <http://www.capcom.com>; Internet; accessed 1 April 2000.

[65] Profile examples as revealed in *Army Leadership*, Field Manual 22-100, U.S. Department of the Army, 31 August 1999.

[66] TRADOC Military History Program, U.S. Army Training and Doctrine Command, <http://www-tradoc.monroe.army.mil/historian/HISTOPGM.HTM>; Internet; accessed 3 April 2000.

[67] *Ibid.*

[68] Dr. Robert E. Neilson, Chief, Information Strategy Department, Information Resources Management College, National Defense University, interview by author, 14 December 1999, Fort Leslie J. McNair, District of Columbia.

[69] The prediction represents the American public's unwillingness to support Globalization because of loss in productivity loss, increases in oil prices, workers unwillingness to work longer hour, and rising inflation.

[70] "Globalization – the process of accelerating economic, technological, cultural, and political integration – is bringing citizens from all continents closer together, allowing them to share ideas, goods and information in an instant." *A National Security Strategy for a New Century* (Washington, District of Columbia: The White House, December 1999), 1.

[71] "Between World War II and the outbreak of the Korean War, budgetary limits shrank ground forces to the point that they became *hollow* divisions, lacking the personnel, equipment and training required for full combat effectiveness." (Taken from *Prelude to Army XXI*; Center for Army Lessons Learned, Fort Leavenworth, Kansas; available from <http://call.army.mil/call/exfor/armyxxi/xxi.htm>; Internet; accessed 2 April 2000; 7).

[72] Strategic Crisis Exercises, held annually at the Center for Strategic Leadership in Collins Hall on Carlisle Barracks, Pennsylvania, whereby Army War College Students, representing military roles that included the combatant Command-in-Chiefs (CINCs), the joint and service staffs and the supporting CINCs.

[73] The disconsolate attitude of American public favored less usage of the Reserve and National Guard because worldwide deployments tore their balance in business with the loss of their employees. The American public scorned any loss of life in a small regional conflict that they feel is not a national security issue.

[74] "And it certainly didn't stop the Chinese from buying virtually an entire production line of this former defense factory in Columbus, Ohio, that manufactured some of the most advanced weapons in the U.S. arsenal. Plant 85, as the Defense Department called it, was built for the U.S. Navy in 1941 to make fighter planes for World War II and, later, Korea. Until a few years ago, it was used to turn out components for the B-1 bomber, the MS missile and the Titan missile." (Extracted from the *60 Minutes* Transcript, Steve Kroft, "The China Connection," 7 June 1998).

[75] Steve Kroft, "The China Connection," *60 Minutes*, CBS. Inc., Transcript, 7 June 1998.

[76] *Ibid.*

[77] *A National Security Strategy for a New Century* (Washington, District of Columbia: The White House, December 1999), 1.

[78] ""Globalization – the process of accelerating economic, technological, cultural, and political integration – is bringing citizens from all continents closer together, allowing them to share ideas, goods and information in an instant." *A National Security Strategy for a New Century* (Washington, District of Columbia: The White House, December 1999), 1.

[79] "In a swipe at Republicans who say the Pentagon in underfunded and overdeployed, Vice President Gore's national security adviser (Leon Fuerth) defended the Clinton administration's defense policies Wednesday (22 March 2000) and said to expect more of the same if Gore wins the White House. The vice president 'believes that you can't build American security simply by mechanically increasing the size of the defense budget,' Leon Fuerth told defense writers. 'You have to invest in the struggle of other countries to develop and grow. That's one of the best ways to avoid futures in which military conflict becomes the only solution to the problems that may be in gestation now.'" (Taken from "Adviser Speaks in Defense of Defense Policy," *USA Today*, 23 March 2000, 12A.)

[80] Managing means "identifying, capturing, prioritizing, organizing, creating, and sharing."

[81] "Adviser Speaks in Defense of Defense Policy," *USA Today*, 23 March 2000, 12A.

[82] *Prelude to Army XXI*; Center for Army Lessons Learned, Fort Leavenworth, Kansas; available from <http://call.army.mil/call/exfor/armyxxi/xxi.htm>; Internet; accessed 2 April 2000; 3.

[83] *Ibid.*, 5.

[84] "And it certainly didn't stop the Chinese from buying virtually an entire production line of this former defense factory in Columbus, Ohio, that manufactured some of the most advanced weapons in the U.S. arsenal. Plant 85, as the Defense Department called it, was built for the U.S. Navy in 1941 to make fighter planes for World War II and, later, Korea. Until a few years ago, it was used to turn out components for the B-1 bomber, the MX missile and the Titan missile." (Taken from *60 Minutes* Transcript, Steve Kroft, "The China Connection," 7 June 1998).

[85] Kroft.

[86] *Ibid.*

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